competition

ONTARIO HYDRO

Finding New Paths To The Customer

convergence

customer choice

Ontario Hydro Management's
Submission to the Advisory Committee
on Competition in Ontario's
Electricity System

Appendices

January 25, 1996

APPENDICES TO ONTARIO HYDRO MANAGEMENT'S PROPOSAL

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A January 1996 Hydro staff paper summarizing customer and consumer views obtained through attitude research and a series of consumer panels held across the province in 1995.

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APPENDIX A

Customer and Consumer Attitudes to Restructuring Ontario's Electricity Services Industry

CUSTOMER/CONSUMER ATTITUDES TO RESTRUCTURING ONTARIO'S ELECTRICITY SERVICES INDUSTRY

1. INTRODUCTION

This paper documents customer/consumer attitudes toward major issues contained in the report entitled Competition, Convergence and Customer Choice Finding New Paths to the Customer by Restructuring Ontario's Electricity Services Sector, dated September 30, 1995. This paper is based on customer attitude research primarily conducted for Ontario Hydro's Planning and Performance Index and information obtained in meetings held with Ontario Hydro's consumer advisory panels.

For the past several years, Ontario Hydro has conducted an annual research program now called The Planning and Performance Index which is designed to create a set of actionable tools for Ontario Hydro to measure the performance efforts of various business units and core staff functions. The program is divided into two basic elements: a planning module to develop information to guide the planning efforts of the various business units and a performance module to provide feedback as to the success or failure of their previous efforts.

The research is conducted by Goldfarb Consultants. Its purposes are to provide information that can be used in business planning for the next year and compare corporate performance against the current business plan and to identify consumer and customer service expectations and to measure their satisfaction with current service.

The research methodology comprises both questionnaires and interviews. Questionnaires are designed for the following customer classes: Hydro commercial, municipal utility commercial, industrial (under 5MW), Hydro agricultural, Hydro residential, municipal utility residential, and Hydro seasonal. Face-to-face executive interviews are conducted with municipal utility general managers, retail utility managers, Hydro direct industrials, and over 5 MW industrials. In total, 2,692 questionnaires were completed, and 284 interviews were conducted face-to-face.

The results of this research and other customized attitude research undertaken by Ontario Hydro have been used to document customer/consumer attitudes to the major elements of our above-mentioned report and are referred to in this paper as customer attitude research.

Ontario Hydro consumer advisory panels comprised of residential, commercial, small industrial and agricultural customers were established in 1995 to enhance understanding of consumer constituencies; to assist Ontario Hydro in anticipating and fulfilling consumer needs; to gain consumer input on policies, programs, plans and projects having a direct impact on consumers; and to develop a feedback mechanism for consumers by providing a third party source of information about Hydro. More specifically, they were designed to acquire consumer feedback on corporate strategic planning initiatives and to gain qualitative evaluations on the effectiveness of specific business plan initiatives and actions, to assist in assessing existing corporate programs and initiatives, and to guide the design of new initiatives.

Four panels of approximately 16 members each were formed in Toronto, Ottawa, London and Sudbury and met four times in 1995. The meetings were facilitated by an independent consulting firm, Pat

Delbridge and Associates (PDA). Panel members were recruited by PDA, and the resulting composition of the panels was as follows:

- residential customers from different geographic locations
- agricultural customers
- small business/industrial customers
- institutional/local community facility customers
- high tech/telecommuting/hydro-dependent customer
- resort/cottage real estate manager
- small apartment complex manager

Meetings were held from 4:00 to 7:00 pm with dinner following. Panel members were sent background material for review in advance of the meetings along with a draft agenda. A typical meeting's agenda began with an update by Ontario Hydro on topics from the last meeting with feedback and comment from panel members. The panels usually discussed two topics which were introduced by a brief presentation of information by Hydro staff during the meeting. The discussion topics in 1995 were based on the restructuring of the electricity sector and hence included competition, customer choice, and financial and industry restructuring. PDA was responsible for taking notes of the meetings.

A final report on the consumer advisory panels was prepared by PDA Partners in December 1995 and forms the basis for the views documented in this paper.

The paper commences with the attitudes expressed towards competition which is the basis for many of the other sections that reflect concerns or changes that have to be made to create a competitive environment.

2. COMPETITION

Based on our customer attitude research and information obtained through the consumer advisory panels, the majority of customers/consumers believe that there should be competition for Ontario Hydro in the electricity industry. Large industrial customers are the strongest supporters of competition. Most customers believe that competition would lead to better prices and improved customer service. According to PDA, the initial reaction to the topic of competition was positive from all panel members. Competition is needed to drive efficiency improvements that would result in increased productivity and lower prices for all consumers.

However, consumer advisory panel members also identified six major issues that would have to be addressed in any movement towards competition; namely, reliability and security of supply; ownership; debt and stranded assets; price and the implications of consumer choice; accountability and the need for restructuring; competition as the only option. The customer attitude data also indicated that customers need assurances on planning with respect to security of supply and reliability standards which have always been set by Ontario Hydro. They are also concerned about the effects of the debt load on Hydro's ability to compete and about fewer taxpayers having to cover Ontario Hydro's debt.

Several consumer advisory panel members found it difficult to reconcile the conflict inherent in their potential liability for the debt as taxpayers versus their interest in consumers' having the potential to significantly lower their electricity costs. While many panel members were attracted to the idea of

competition, they also very quickly expressed the concern that any savings might be lost to them as taxpayers if they had to carry an additional tax burden to pay down the debt.

With respect to price, although all panel members were personally interested in reduced rates, many members stated that they understood that the entry of competition in other traditionally monopolistic industries (such as telecommunications) had led to higher overall costs and prices for consumers. Panel members understood and accepted that large business users are looking for lower prices, and they had no difficulty with the concept of moving to a process that would meet these needs. They were not willing, however, to see their own prices rise to provide lower rates for large users "as they have in telephone services." Most panel members believed that, whatever form of competition is chosen, it must be meaningful for and provide some advantages to the ordinary residential user as well as large customers.

The issue of competitive threats was also identified. PDA stated that, while there was general agreement that Hydro must continue to change, not all panel members believe that the company should voluntarily open itself up to competition. In their opinion, although changes need to be made, it would be better if Hydro strengthened its organizational efficiency to ward off potential competitive threats. However, the customer attitude research indicated that customers believe that competition would make Ontario Hydro more efficient and better able to ward off competitors. Any rejection of competition was based on satisfaction with the status quo, avoiding duplication of services, and the need to protect the essential service nature of electricity.

i. Competition in Generation

According to PDA, there was support across the province for competition in generation. With 70 percent of the cost of production in generation, most panel members thought that this was the best place to encourage competition because it offered the greatest opportunity for cost savings and would have the least impact on service reliability. These panel members preferred to begin with competition in generation only because Hydro would be able to have control as it moves into a competitive environment. In addition, the majority of residential panel members were not interested in dealing directly with a generator.

The major element of concern for panel members, however, in any movement towards a competitive environment related to the fear of stranded assets' increasing the liability of the Ontario taxpayer. A majority of panel members expressed the strongly held view that, until Ontario Hydro was in a more financially secure position with the debt to equity ratio significantly lowered, competition should not be encouraged, particularly in generation.

According to the customer attitude research, private generators have a role to play in the provision of electricity but should not be in a majority position. They must also be Ontario-based suppliers; there is strong opposition to non-Canadian suppliers. Among all customer classes, Ontario Hydro is the supplier of choice.

ii. Competition in Transmission

According to PDA, panel members saw the transmission of electricity as a natural monopoly. They did not believe that it would be cost effective to have different companies compete in the wires end of the

business. The customer attitude research also indicated that transmission is viewed as a natural monopoly.

3. NEED FOR CHANGE

According to PDA, all consumer advisory panel members felt that change was already underway at Ontario Hydro and that the change process was necessary and should be supported and promoted. The majority of comments on the need for change centered on the need for Ontario Hydro to be run more like a business. Panel members spoke of the need to find a mechanism that would "keep Ontario Hydro on its toes" perhaps by having one or more existing generating facilities operated by the private sector or by having existing operations benchmarked against efficient operations in other jurisdictions. Although the issue of competitiveness was raised from the earliest stages of the discussion, it is important to note that, in the consumer's mind, competitiveness was related to Hydro's having to operate as the most efficient business possible rather than enabling other service providers to compete.

4. INDUSTRY RESTRUCTURING

With respect to industry restructuring, a number of topics were addressed at the consumer advisory panel meetings including retail competition with customer choice of suppliers and the need for new market mechanisms such as the price averaging pool (PAP) and the spot market.

According to PDA, many of the panels' small business members and some consumers, primarily in Metro Toronto, supported retail competition. Small business members already negotiate with brokers in other areas of their business and were comfortable doing the same for electricity. Most business customers were confident that savings could be realized, and it would be well worth the time to evaluate the different options.

Based on our attitude research, industrial customers also had little concern about an electricity spot market which they indicated would lead to better rates, security of supply, and innovation.

However, according to PDA, most residential panel members were quite sceptical about retail competition and had real concerns about whether or not the market model had a mechanism to look after the public interest. They were not confident that retail competition would bring lower prices. Even if it did, the trade-offs might not be worth it; competition in this area might only lead to massive consumer confusion and endanger service reliability and safety. In addition, many panel members and the majority of residential panel members had no interest in dealing with a broker.

With respect to competition in generation only, some panel members had concerns with Hydro's having a monopoly over the rest of the system. According to PDA, they felt that Ontario Hydro would have a conflict of interest if it competed to sell power into the pool while also being responsible for managing the pool and selecting which generators contributed to it. They thought that competition in generation was unwise because it would threaten security of supply. Isolated areas and Ontario as a whole would suffer if no mechanism existed to ensure supply.

Customer attitude research has indicated that customers see the need to create market mechanisms which lead to a more accountable Hydro. According to PDA, consumer advisory panel members also were prepared to accept a market mechanism provided that instruments were put in place to safeguard against the potential threats to reliability, security of supply, and rates from a market based system. Many felt that the Price Averaging Pool (PAP) was that mechanism. They were confident that if Hydro ran the PAP, reliability of service would be guaranteed. For many panel members, the idea of the pool's operating across the province within a competitive market seemed to provide the best of both worlds: rates would be competitive while, at the same time, there would be equity of service and reliability of supply. The PAP also was seen as building in pricing accountability.

However, consumer advisory panel members acknowledged that the success of the PAP would depend on the number of customers in the pool: the more that join the PAP, the better the rate; the fewer who join, the higher the rate. The value of the PAP would be dependent on whether or not it could offer competitive service and pricing. Most panel members were confident that Hydro could create a competitive PAP and indicated their desire to be part of it. Some panel members, however, questioned the whole need to move to a market based approach only to return to the PAP.

There were a few panel members who thought that the PAP would have an unfair advantage over its competition in that it would be the easiest supplier to choose for the average person. Many saw the PAP as a reincarnation of Ontario Hydro and as an entity that would, in effect, have a substantial market share handed to it without having to compete for it.

5. CUSTOMER CHOICE

All consumer advisory panel members stated that they liked the concept of consumer choice. As indicated earlier, panel members from small and medium enterprises, particularly those with experience with gas vendors, felt more able to evaluate and pick a reliable supplier than the residential panel members and were therefore attracted to some form of brokerage system.

Many residential panel members thought that brokerage would be too complicated, confusing and time consuming and questioned whether or not they would really save much (or any) money. Some found the proposal frightening and were concerned at the implications of moving into much more of a "buyer beware" situation. There were fears of third party suppliers not living up to their promises, declaring bankruptcy, and leaving consumers to face additional costs and service interruptions.

While supporting the concepts of competitive prices and choice, residential panel members felt that it would be extremely important to provide some form of "travel industry type" safety net, along with service standards identified and supervised by informed third parties. Panel members feel that it is critical that mechanisms be put in place to safeguard reliability, accessibility and future power supply against the potential threats of a market based system. Consumers would also have to be provided with a great deal of support and information.

However, having a choice from among the PAP or brokers or buying direct would add to accountability. Panel members liked the idea that every consumer had the choice of playing the open market or dealing with the PAP. Customers could rate generators, brokers and the PAP on their environmental performance, their customer service, and their education programs. They saw the PAP as a stabilizing influence and thought that many customers would opt for it.

Unbundling was a difficult issue for the consumer advisory panel members to address because, according to PDA, they did not see the product and services as discrete entities. While other industries have been able to unbundle and charge additional fees for some services, electricity was seen as an essential "one package" service. However, there was some attraction to providing an opportunity for local businesses to provide installation and energy efficiency services.

By and large, panel members like the concept of consumer choice but are sceptical about whether or not the benefits would materialize in the real world of competing generators and distributors.

6. CONVERGENCE/BUSINESS OPPORTUNITIES

The customer attitude research found widespread agreement among customers that Ontario Hydro should undertake research into new generation technologies, more efficient uses of electricity, technologies that are renewable, and new electrical applications in industry. Ontario Hydro should also market or rent technologies that are efficient or renewable, export electricity, and sell consulting services outside Ontario and Canada. However, there was widespread rejection of Ontario Hydro's involvement in investing in natural gas companies and in electrical utilities outside Canada.

Consumer advisory panel members stated that, if other utilities were allowed into the province to compete, Ontario Hydro should also be able to seek out new markets. They also stated that efficiencies could be gained through cooperation between utilities -- combining cable, phone, and Hydro into a single pipe into the home or business.

7. PRIVATIZATION

Based on both the discussions held at the consumer advisory panel meetings and the survey results, there is some confusion surrounding the distinction between competition and privatization. Although presentations to the panel and subsequent discussions had dealt with the topics of competition in generation and transmission without introducing the topic of ownership, for example, PDA reports that panel members felt that privatization was not the only way to make Ontario Hydro competitive.

Some panel members felt that Ontario Hydro should examine the options of privatizing some facilities or running them as profit centres as alternatives to the introduction of competition in order to make Ontario Hydro more competitive. Other panel members felt that some form of privatization of one or more generating sources would reduce the debt while also providing the necessary efficiency reference point that would encourage Ontario Hydro to compete more effectively.

There was concern by some panel members that, in the current surplus situation, a "fire sale" might occur which would reduce the value of the assets built up over time by Ontarians. Several business members were also concerned that, if a more independent Hydro went to raise money in the market with its own credit rating, the real net worth of Ontario Hydro might be lower than stated.

The customer attitude research indicates that there is moderate support for selling part of Ontario Hydro as a means of introducing competition; the sale of international business and energy audit service receives the greatest support. However, the public wants the proceeds from the sale of any of these assets to be applied to Hydro's debt.

But, there is strong support for keeping Ontario Hydro together in order to compete in the North American market. There is also strong opposition to any buyers/suppliers from outside of Ontario and a need to ensure that Ontario energy interests are protected.

Most of those surveyed want Hydro to be at least 60 percent government owned because electricity is viewed as an essential service. The core business (some generation and distribution) should be owned by Ontario Hydro. Concerns were also expressed about nuclear and grid privatization; nuclear because of safety concerns and grid because it is viewed as a natural monopoly. Consumer advisory panel members, as well, do not see electricity like other commodities -- telephone, gas or cable -- but as a "crucial service that is essential to life."

8. REGULATION

Consumer advisory panel members strongly believe that there is a lack of accountability in Ontario Hydro in the existing structure and, in addition, that there is no independent body watching over Hydro's activities to ensure that the public's best interests are protected. There is no real mechanism for accountability to the public. According to PDA, panel members felt that the regulatory process has been geared to monitor costs and not consumer needs.

Panel members stated that, while the existing politically driven accountability structure needs to change, they did not want a competitive environment to operate in a regulatory vacuum. They stressed the importance of having a regulatory framework or some other mechanism that provides a clearly defined mandate and direction for the future. Panel members felt that, if there were wide open competition, the government would have to create new laws or regulations, perhaps even legislate the amount of electricity to be produced in Ontario.

APPENDIX B

Generation Configurations for Competitive Markets

Ontario Hydro Generation Configurations for Competitive Markets

Ontario Hydro
January 24/96

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SUMMARY

The study uses the following objectives to assess the performance of different generation configurations.

1. Maximize the market value of Ontario Hydro's current generation assets if they were put up for sale.
2. Improve operational efficiency.
3. Increase customer choice.
4. Increase competition.
5. Improve the competitive position of generation businesses.
6. Provide flexibility.

Six generation configurations were created for the assessment from Ontario Hydro's existing hydroelectric, fossil and nuclear generation assets. One configuration has all generation as a fully integrated entity; another has three entities based on fuel technologies; two configurations have two entities, either combining fossil with hydroelectric as one entity and nuclear as the other -- or fossil with nuclear as one and hydroelectric as the other; and two other configurations divide the assets into four or five entities.

No single configuration best meets all objectives; trade-offs are necessary. However, as a general observation of the assessment results configurations with larger entities, especially those that retain synergies within technologies, consistently perform well over all of the objectives. The significant trade-offs among the objectives involve the following: a) the amount of market discipline needed; b) the market value of the generation assets; and c) the benefits of integrating within and among generation technologies. Further quantitative assessments are required to better understand the impacts of the trade-offs.

Market discipline is driven by customer choice and competition, both of which are provided by opening access of all generators to transmission and distribution facilities and customers. In general, a large number of small generation entities will be subject to more market discipline than a small number of large entities.

Market value of assets is linked to revenue expectations. If the market is configured with many small players the ability of the players to recover average costs decreases and prices could collapse to values close to the marginal running costs on the interconnected system. Such a configuration would reduce the market value of the generating assets, which would be strongly influenced by the near term outlook for revenues.

Integration benefits generally provide effective cost efficiencies in the areas such as: fuel acquisition, operating reserve; water regulation and management; maintenance scheduling and delivery of maintenance work; waste management activities. Many of these integration benefits, which add to competitive advantages, would be diminished or lost if the technology groupings were divided. Ontario Hydro Nuclear should remain as a whole in one entity, not only for integration benefits but for focused support for safety and performance.

Market areas, market rules and players in an open North American market will determine prices. In an open northeastern North American market area, the configuration of generation within Ontario would have secondary impacts on prices compared to the impacts of the market rules and the degree of symmetry of rules between market areas and other market players.

No matter what the generation configuration starting point is, capital investment and the market and market rules will reshape the generation entities. Generation entities will change as competition for market share evolves and influences the portfolio of generation an owner can most profitably utilize. The interconnections,

the markets and the market power that exists in neighbouring jurisdictions will influence competition in Ontario. Depending on the market rules, the interconnections allow generators, aggregators, marketers and brokers outside Ontario to compete for market share within Ontario; and they allow Ontario generators, aggregators, marketers and brokers to compete for market share in other jurisdictions. Furthermore, there will be open competition in capital investment to meet load growth, rehabilitate existing facilities or to replace generation that is retired from service.

INTRODUCTION

This paper describes how different configurations of Ontario Hydro's generation assets perform in meeting a number of different objectives germane to electricity industry restructuring.

Ontario Hydro's paper "Competition, Convergence and Customer Choice" (September 30, 1995) proposes that electricity industry restructuring in Ontario is inevitable because of a number of driving forces. Restructuring within the generation sector of the industry will take place as it is the area where new competitive forces are already at play. The paper suggested that Hydro examine options for reconfiguring its generation assets.

Ontario Hydro is not free to set its own objectives; ultimately Hydro's objectives are set by the Ontario government. Therefore, to initiate this study the following questions were set out:

1. What generation configurations best meet selected objectives of restructuring Ontario's electricity industry?

2. How do generation configurations perform under different market structures or market areas?

3. What configurations allow flexibility for responding to shifting emphasis among objectives over time?

APPROACH

The study uses a goals and objectives approach. Hydro's "Competition, Convergence and Customer Choice" paper set out a number of objectives for restructuring Ontario's electric power industry. For the purposes of this study a set of objectives for creating generation configurations are developed. These generation configuration objectives (next page) are consistent with the broader industry restructuring objectives. Unless explicitly stated otherwise, all further references to objectives in this paper are to the generation configuration objectives.

Next, a number of generation configurations are postulated. Criteria that further specify each objective are used in making qualitative assessments of the impacts of each generation configuration. For each criterion the performance of the configurations are ranked. When there is more than one criterion under an objective, the study group made an overall assessment and ranking of the configurations by weighing the importance of the criteria and the magnitude of the impacts.

As noted earlier, ultimately Hydro's objectives are set by government. Therefore this study does not set priorities or make trade-offs among objectives.

ASSUMPTIONS

- All generation entities within a configuration would initially be financially restructured with the expectation that they will be able to compete and succeed.

This assumption essentially recognizes Ontario Hydro's debt as a corporate matter to be dealt at a corporate

level through policy determined by government. Therefore, stranded investment, while it is an important issue, is not a primary consideration in assessing the generation configurations. Nevertheless, the potential for stranded investment is related to the market value of generation entities and as such it is captured in the assessment of generation configurations under the first objective (refer to the assessment section).

- Electricity prices in an open market are uncertain and unpredictable because it is the market area, the market rules, the degree of symmetry of market rules between neighbouring jurisdictions together with all the market players that will determine prices.

- An open access market is assumed. The electricity market in Ontario will offer both a spot market and a contract market for electricity purchases or hedging electricity prices. Generators will compete in both markets and would be paid market prices.

- Generation configurations are made up of one or more generation entities. It is assumed that within a generation configuration the entities are independent. However, no distinction is made in the assessments between public or private ownership, unless specifically noted.

OBJECTIVES FOR CREATING GENERATION CONFIGURATIONS

The study group set out the following objectives to use in assessing the performance of different generation configurations.

1. Maximize the market value of Ontario Hydro's current generation assets if they were put up for sale.

2. Improve operational efficiency.

3. Increase customer choice.

4. Increase competition.

5. Improve the competitive position of generation businesses.

6. Provide flexibility.

Criteria that further specify the objectives are set out later along with the assessments.

The objectives can serve different interests. For example, customers may be most interested in the first four objectives and different customers may have different priorities among the four; taxpayers may be most interested in the first objective in order to reduce their exposure to stranded investment; government may be most interested in the first, fourth and fifth objectives to reduce its contingent liability and to foster a competitive Ontario economy; and a business owner or manager may be most interested in the second, fifth and sixth objectives to enhance their own long-term profitability. Therefore, it is unlikely that any one generation configuration would meet all objectives or all interests; trade-offs would be necessary.

GENERATION CONFIGURATION OPTIONS

This paper focuses on options for configuring Ontario Hydro's existing generation. The other market players are summarized below and further details are provided in Appendix C.

Suppliers	Capacity MW	Typical Energy Production TWh/a	Other Characteristics
Ontario Hydro	29,100	135	About 2,800 MW of capacity is mothballed and not included in the capacity value
Existing NUGs	about 1,500	about 11	Most have 'must run' contracts to supply Ontario Hydro
Customer generation and other utilities	about 1,500	about 6	Can supply excess capacity and energy
Interconnections	about 2,500 to 4,000	up to 15 - 20 in or out of the province	Potential capacity as high as 4,000 MW, but not always possible; many other utility and generation entities can access the interconnections
New Entrants	0	0	New entrants can enter an open access market at any time.
Agents (aggregators, marketers and brokers)	0	0	Agents are beginning to become active in the Ontario market, in expectation of open access here and across North America.

Significance of Interconnections

Ontario is interconnected with Michigan, New York, Quebec, Manitoba and Minnesota. Based on the capacity of the interconnection system, Ontario can export to the U.S. up to roughly 4300 MW. Similarly, utilities in the northeastern part of the U.S. can transmit into Ontario up to roughly 2800 MW in summer and 3800 MW in winter.

Based on current cost structures, the ECAR utilities (East Central Area Reliability coordination agreement) in Ohio, West Virginia, Indiana and Michigan are the biggest competitors to Ontario Hydro in the northeastern North American market. These utilities are low cost producers with large capacity surplus in total and are willing to sell energy at any price above their marginal production costs. Other utilities in northeastern U.S. in New York, New England and along the Atlantic coast are high cost markets and would be likely buyers from Ontario and ECAR. Quebec can sell into the U.S. through its interconnections more profitably than it could sell into the Ontario market and so will compete primarily in the U.S. market. Ontario's interconnections with Manitoba and Minnesota have limited transfer capability (up to 200 MW and 150 MW respectively) and thus pose a small competitive threat\opportunity to the Ontario system, but would pose a significant threat\opportunity to a northwestern Ontario regional generation entity.

Appendix B provides more information on interconnections capabilities.

Ontario Hydro configuration options

The capacity and energy characteristics of Ontario Hydro's existing generation assets are described in Appendix C. Currently Hydro has generation business units established by generation technology: Hydroelectric Business Unit (HBU), Fossil Business Unit (FBU) and Ontario Hydro Nuclear (OHN).

Six generation configurations were created for the assessment. Throughout the rest of this paper the configurations are referred to by number for expediency, but a footnote provides the short verbal description of the numbered configurations.

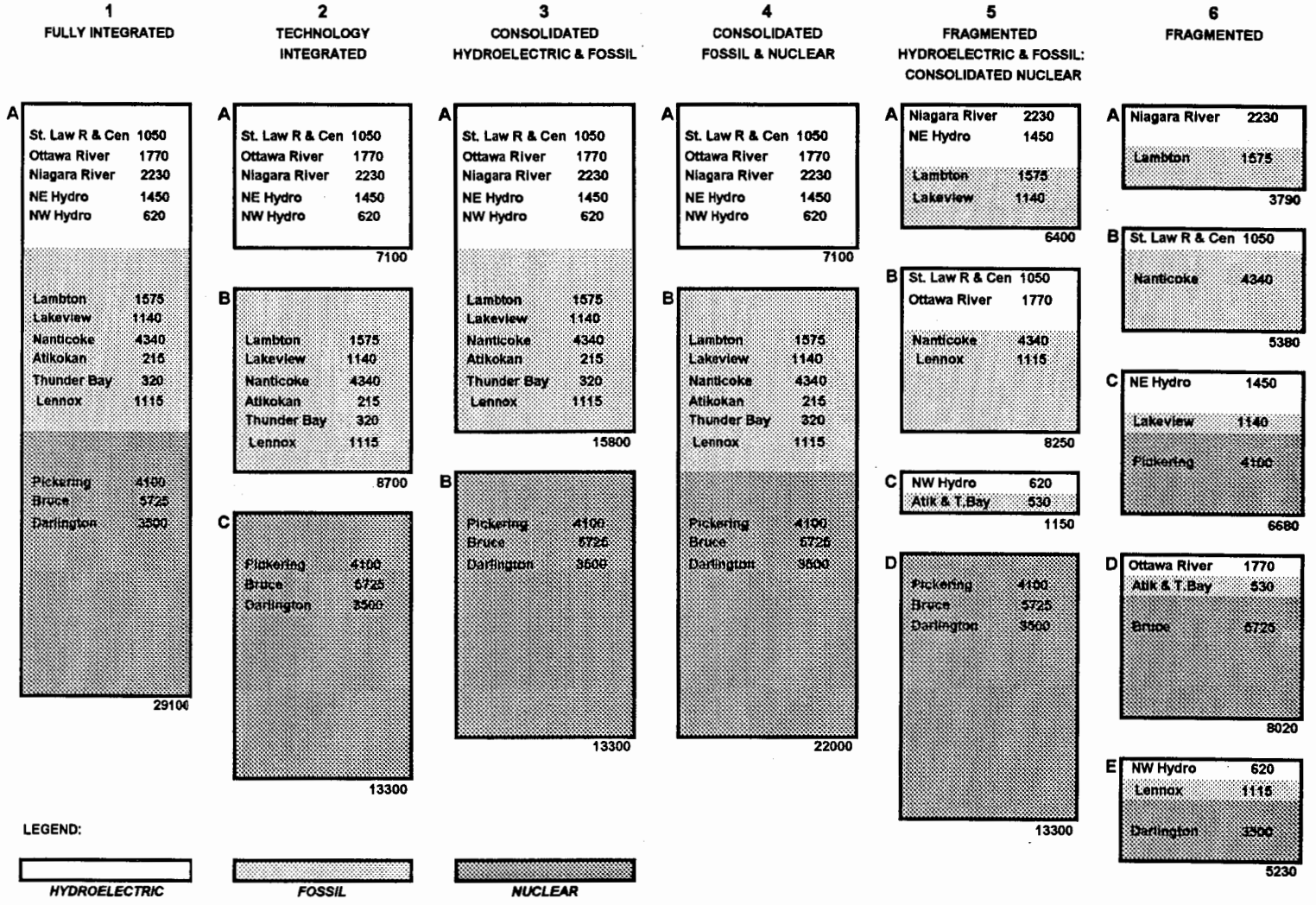
The following table and figure (next page) illustrate the key features of the six configurations.

Generation Configurations #	Description	Generation Entities		Current In-service Capacity MW	Typical Annual Energy TWh/a
1	Fully integrated	HBU + FBU + OHN	(a)	29,100	135
2	Technology integrated	HBU	(a)	7,100	35
		FBU	(b)	8,700	10
		OHN	(c)	13,300	90
3	Consolidated hydroelectric and fossil	HBU + FBU	(a)	15,800	45
		OHN	(b)	13,300	90
4	Consolidated fossil and nuclear	HBU	(a)	7,100	35
		FBU + OHN	(b)	22,000	100
5	Fragmented hydroelectric and fossil; Consolidated nuclear	Niagara River and NE hydroelectric, Lambton, Lakeview	(a)	6,400	20
		St. Lawrence River, Ottawa River and central hydroelectric, Nanticoke, Lennox	(b)	8,250	20
		West System (Atikokan, Thunder Bay, NW hydroelectric)	(c)	1,150	6
		OHN	(d)	13,300	90
6	Fragmented	Niagara River hydroelectric, Lambton	(a)	3,790	16
		St. Lawrence River and central hydroelectric, Nanticoke	(b)	5,380	11
		Pickering, Lakeview, NE hydroelectric	(c)	6,680	35
		Bruce, Atikokan, Thunder Bay, Ottawa River hydroelectric	(d)	8,020	42
		Darlington, Lennox, NW hydroelectric	(e)	5,230	30

NE - northeastern Ontario NW - northwestern Ontario

HBU - Hydroelectric Business Unit FBU - Fossil Business Unit OHN - Ontario Hydro Nuclear

FIGURE 1
GENERATION CONFIGURATIONS BY CAPACITY



Configuration 1 is representative of the current situation, where HBU, FBU and OHN are a single entity and operated, for the most part, as a coordinated set.

Configuration 2 establishes HBU, FBU and OHN as fully independent entities. This simply injects independence into the current situation.

Configuration 3 establishes HBU and FBU together as one independent entity and OHN as another because this would provide two entities of roughly equal size in terms of generating capacity.

Configuration 4 establishes HBU as one independent entity and FBU and OHN together as another because this places the steam technologies together for synergistic benefits of knowledge of operations and maintenance of steam plant, and it allows both entities to provide a full range of products; namely base, intermediate and peak load. Otherwise, OHN without FBU would be limited to base load supply services only.

Configuration 5 establishes four entities: OHN as one independent entity; all the hydroelectric and fossil generation in northwestern Ontario (i.e. the 'West System' as known within Hydro) as another independent entity; and from the remainder of the HBU and FBU two independent entities of mixed hydroelectric and fossil generation. These latter two would provide competition between entities of similar size and capability. The 'West System' is a natural choice for a regional entity and because of geography and because of transmission constraints between that region and the rest of Ontario. Rationale for maintaining OHN as a whole is provided in Appendix A.

Configuration 6 establishes five entities because up to five entities have been suggested as necessary for competition. All the independent entities have mixed hydroelectric and fossil assets; three of the entities have nuclear generation, allocated by site (e.g. Pickering, Bruce and Darlington); the other two entities were each allocated the largest of the hydroelectric base load generation sites (Niagara and St. Lawrence).

Configurations 5 and 6 are representative of more fragmented configurations. Better arrangements may be possible but they are adequate for broadly assessing the performance of smaller generation entities against the objectives.

In all of the configurations the grouping of hydroelectric generators within entities is based on river systems except Configuration 6 where there are links between rivers systems among two of the entities.

Appendix B provides a general discussion about competition among hydroelectric, fossil and nuclear generators to supply customer demand.

Assessments

The six generation configurations are assessed using criteria that are derived from each of the objectives that a generation configuration would ideally achieve.

Objective 1. *Maximize the market value of Ontario Hydro's current generation assets if they were put up for sale.*

The assessment applies the following criterion: the expected value of the net revenue stream. Two risks were considered. One was the ability of entities to withstand production losses as a function of technological operating risks. The other risk was the ability of entities within a configuration to withstand the impacts of low market prices for electricity. Low prices may also reflect the risk of maintaining\increasing market share.

Operational risks

Of all the technologies, nuclear presents the most significant technical operational risks and consequences (e.g. pressure tube and steam generator performance and the unknown effects and impacts of aging). Therefore, configurations that provide diversity in generation (Configurations 1 and 4) can be expected to be less vulnerable than configurations that have nuclear as a single and separate entity (Configurations 2, 3, and 5). However, the configuration that divides nuclear (Configuration 6) is judged to be the most vulnerable to revenue impacts due to operational risks because the nuclear generator represents a substantial portion of the entities total energy production capability. With all of nuclear as one entity, there is a greater chance that the risk can be managed. For example design improvements learned on older units can be transferred to the younger units reducing or even eliminating production losses associated with the technical problem.

Price risks

Under low market prices generation entities with high fixed costs\low operating costs might not cover interest and depreciation expenses, but could afford to run. On the other hand, entities with high operating costs\low fixed costs might run but earn a thin margin over costs, or even no margin at all if the price drops too much. In general, larger entities have less risk of financial failure because there is less chance of intense price competition in the first place, and if there are price wars, they have more options to manage the risks. Therefore, Configurations 1, 2, 3 and 4 are judged to perform best, followed by Configuration 5, and Configuration 6 is ranked last.

Objective 1 - overall

Configuration 1 is judged to best meet the objective of maximizing market value of current assets, followed by Configuration 4. Configurations 2,3 and 5 are ranked next as a group; Configuration 6 is ranked last overall.

Objective 2. Improve operational efficiency.

The criteria applied are:
- the potential for management control, where higher control is assumed to mean greater efficiency through reduction of some business costs;
- the potential for management efficiency, where economies of scale in internal business activities are assumed to be achievable;
- the potential for operational integration benefits (particular to electricity generation and supply); and
- the opportunity for sustainable energy development (e.g. energy efficiency undertaken by a generation entity, operating emissions, waste management and stewardship).

Management Control

Management control is the ability to know what resources are needed and to ensure that the resources are deployed to achieve the highest value for the business. Generally, larger organizations are vulnerable to a reduction in management control. Empire building is an example of reduced management control; while various departments and their people may be busy, they may not be focused on the right task for the most benefit. Consequently, configurations with smaller entities (Configurations 6 and 5) perform better than configurations with large entities (Configurations 1 and 4).

Management Efficiency

Economies of scale can be achieved with size. Accounts receivable, billing, engineering, and purchasing are examples of service functions that can be delivered more efficiently by larger entities than smaller entities. As a result, smaller entities might rely more on purchased services. It is possible that over time, the efficiencies achieved by internal services within larger entities could be replicated over time if the purchased service providers are aiming to capture their own economies of scale. Overall, configurations with larger entities are judged to perform better under this criterion than configurations with smaller entities.

Benefits of operational integration

Two levels of integration benefits contribute to cost efficiency; system benefits which arise among technologies and technical synergies that arise within technologies. Generation within the Ontario Hydro system was designed to be complementary and to achieve these benefits. For example the fossil and hydroelectric mix in Configurations 1, 3, 5 and 6 can be advantageous when hydroelectric is energy limited or when fossil flexibility is constrained. With fossil as reserve, most hydroelectric sites could be developed to their full potential. Hydroelectric can offset the loading time for fossil during peak hours. Water utilization during high flow seasons can be maximized with support from fossil for operating reserve, and during low flow seasons fossil can hedge the revenue risk for hydroelectric from drought conditions.

There are also benefits through coordinated dispatch, such as planning hydroelectric and fossil dispatch and operating output levels so that thermal cycling of fossil units is minimized. Thermal cycling can impact the long term performance of generation assets.

Configuration 1 - Fully Integrated (H+F+N)
Configuration 2 - Technology Integrated (H\F\N)
Configuration 3 - Consolidated H&F
(H - hydroelectric; F - fossil; N - nuclear)

Configuration 4 - Consolidated F&N
Configuration 5 - Fragmented H&F; Consolidated N
Configuration 6 - Fragmented

Other system benefits among technologies and synergies within technologies include negotiating power with suppliers of fuel and services, coordinating maintenance scheduling and delivering maintenance programs, sharing technical expertise, optimizing fuel inventories, regulating water levels and flows, managing wastes, financing, planning and marketing. Many of the integration benefits would be diminished or lost as generation is divided, and particularly as fuel technology groupings themselves are divided.

For example, the separation of the hydroelectric system into several competing entities (Configurations 6 and 5) would change water management strategies. Depending on the amount and timing of spillage, up to 1 TWh of electrical energy could be spilt. Depending on market prices, this would represent a value of 25 M$/a to 50 M$/a.

Retaining nuclear generation within a single entity: a) is consistent with a comparison of the best performing nuclear stations in the world, based on cost, safety and operational performance, which generally shows advantages of size i.e. ownership of several stations, particularly multi-units stations; and b) provides focused support for the human resource and physical assets through a board of directors and senior management team committed to excellence in safety and performance.

Appendix A provides additional information of the benefits of integration.

Under the criterion of benefits of integration, configurations that retain the existing hydroelectric, nuclear and fossil entities as whole units (Configurations 1, 2, 3 and 4) are judge to perform better than those that do not, particularly Configuration 6, which fragments the existing entities the most.

Consistency with sustainable energy development

Generally, the larger the entities the easier it is believed that SED initiatives can be coordinated between businesses through voluntary initiatives or mandated through public policy. For example, fossil facilities as a whole currently must operate within an emissions cap. More flexibility and administrative efficiency in managing emissions is attainable if fossil facilities are operated as a whole compared to separate entities. The same is true if emission caps are replaced by a regional emissions trading scheme. Larger entities may also be better able to afford and promote renewable energy technologies and energy efficiency initiatives with longer payback periods.

Some of the benefits of integration also apply under this criterion, such as minimizing water spillage and voluntary watershed management initiatives for environmental \ citizenship benefits.

As a result, Configurations 1, 2, 3 and 4 are judged to perform best. Configuration 2 might not perform to the same degree as the others if the independent fossil entity was successful at gaining market share from entities with lower running costs and lower operating emissions (e.g. if hydroelectric was spilling water or nuclear was able to produce but having to remain idle).

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Configuration 5 - Fragmented H&F; Consolidated N
Configuration 6 - Fragmented

Objective 2 - overall

The criterion of operational integration benefits is judged to carry the most weight under this objective because of the magnitude of cost efficiencies achieved by integration and the parallel between efficiencies achieved through integration and the efficiencies desired through sustainable energy development.

Configuration 3 is judged to perform best, followed closely by Configuration 2 and 4 (in that order). Configurations 1 and 5 follow next. Configuration 6 is ranked last; the benefits of management control do not outweigh the loss of operational integration benefits.

Objective 3. Increase customer choice.

The criteria applied are:
- the number of suppliers customers have to choose from;
- the ability for products and services to be differentiated and offered to customers;
- the ability of customers to distinguish suppliers by local, provincial, national or foreign ownership; and
- the ability of customers to distinguish suppliers by environmental performance.

Ontario Hydro's customer research indicates that customers do value choice and that ownership and environmental performance are important considerations.

Number of suppliers

Based on the number of independent entities within each configuration, Configuration 6 performs best, followed by 5, 2, 3 and 4, and 1, in that order. However, with Configuration 5, in spite of the greater number of suppliers, customers in northwestern Ontario may see little effective choice because the West System remains as one entity.

Differentiated products and services

In an open access market any generation entity will be able to create and package products and services of comparable value to the customer. There is no reason to believe, for example, that a smaller entity would be any less reliable in providing services than a larger entity. However, it will be a matter of costs and consequently the profit margin of one entity's products and services could be different from another. Hence certain entities in some configurations may develop product and service niches.

The market will also provide agents (aggregators of customers, marketers, brokers) who can package products and services from any number of upstream suppliers for the end-use customer. However, if there is one large entity the options of the agents is limited. Therefore, Configuration 1 performs the worst and no distinction is made among the remaining configurations under this criterion.

Ownership

No distinction is made between the configurations on the basis of local, provincial, national or foreign ownership for several reasons. Under retail open access, any generator is to have equal access to the transmission and distribution system and customers. Agents can package ownership choices for customers if customers ask for it. The reconfiguration of existing Hydro generating assets should not impact access or the ability of agents to package options on the basis of ownership. It is possible that smaller generation entities could be more consistent with, and therefore more conducive to local and distributed generation. However, economical distributed generation technologies will be deployed as the technologies present the opportunities; not as a function of other generation entities and their size. It is also possible that smaller entities could provide more opportunity for foreign ownership and control, but the same can happen through foreign ownership of a sufficient number of shares in a larger entity.

Environmental performance

Environmental performance is linked to the generation technology. Configuration 2 provides the most distinct choice by technology and therefore performs best under this criterion. Configuration 4 is ranked second because the hydroelectric entity remains distinct and that could allow that entity to focus only on renewable technologies, giving customers a distinct environmental choice. Configurations 3 and 5 are judged to be comparable to each other, followed by Configuration 6. Configuration 1 provides the least choice for distinguishing generation technologies by environmental performance.

Objective 3 - overall

The significant distinctions between the configurations are made by the environmental choice and number of suppliers criteria. On the basis that quality of choice is valued more than quantity of choice, Configuration 2 is judged to best meet the objective of increasing customer choice, followed by Configurations 4 and 5. On balance, Configurations 3 and 6 are ranked next; Configuration 1 is ranked last.

It should be noted that opening the market to equal access enables increased customer choice, more so than the configuration of generating entities. With full open access, customers will be able to choose from entities made up from Ontario Hydro generators, utilities outside Ontario over the interconnections, new generation entrants, other smaller utilities in Ontario, and to a limited extent, from existing NUGs and customer self-generators.

Objective 4. Increase competition.

The criterion applied is the amount of competition for like products and services that could take place between the existing Ontario Hydro generation entities. For this assessment, competition provided by other market players, which is common to all configurations, is not considered. Appendix B provides a discussion of the nature of competition and the potential for other market players to provide price discipline within the Ontario market area.

Configuration 6 provides the most competition between entities within Ontario over a range of products and

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Configuration 6 - Fragmented

services, followed by Configuration 5. Configuration 4 is ranked third because its entities can compete on a full range of products and services whereas the entities in Configurations 2 and 3 generally do not (refer to Appendix B for further discussion on where competition takes place). Configuration 1 is ranked last.

Because there is just one criterion, the above represents the overall assessment under this objective.

Objective 5. Improve the competitive position of generation businesses.

The criterion applied is the ability of generation entities to offer a mix of products and services for their own competitive advantage and to be able to attract investment to sustain their business.

Recently there have been mergers and acquisitions among U.S. and U.K. electric utilities. While the reasons for the mergers may be many and varied they have at least one reason in common: the utilities believe that consolidation will help prepare for increased competition in more open electricity markets. Two results of the mergers are that the generation capability under one market player increases, even if some rationalization decreases surplus generation and the current franchised customer base becomes larger. These results provides increased market power and increased flexibility in the event that intense competition leads to price drops that aim to squeeze the weak players out of the market. Typically, the U.S. mergers are resulting in generation companies of about 9,000 MW to 17,000 MW of capacity.

The competitive position of the generation entities themselves also depend on the impact of transmission limits. Customers close to a generator will tend to contract with that generator because of lower transmission costs. For example, a grouping including Saunders GS would need to compete with Hydro Quebec and New York Power Authority. With the addition of more interconnection transmission lines, Saunders may become uneconomical. Conversely, it could also provide additional opportunities for external sales. Appendix B provides further discussion of transmission considerations, customers and customers proximity to generators.

Larger entities achieve benefits of integration and the associated cost efficiencies translate into competitive advantages. Larger entities are also better positioned to expand into wider market areas beyond Ontario, with benefits for Ontario.

Once again, size confers a competitive advantage. Configuration 1, 2, 3 and 4 are judged to perform well. However, Configurations 1 and 4 may have additional advantages because the entities within are better positioned to offer a full range of products and services (e.g. base, intermediate and peak load operations, back up, operating reserves).

Configuration 5 sets the West System generators on their own. However, the West System is quite dependent on neighbouring systems for back up, which is a competitive disadvantage. On the other hand, as the West System has transmission constraints, the West System generators would have regional market power.

Configuration 6 is ranked last because the smaller entities have the least competitive advantages; there is a lack of integration benefits and the entities with nuclear may be considered too risky to attract reinvestment. It is likely that there would be re-integration among the entities.

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Configuration 6 - Fragmented

It should be noted that in the long run, the market will shape and change generation configurations to achieve efficiencies and competitive positions that improve profits. Whether configurations begin with large entities or small entities, they will change through divestments or mergers.

Because there is just one criterion, the above represents the overall assessment under this objective.

Objective 6. Provide flexibility

The criterion applied is the ability to respond to changes in objectives which may occur, given the current uncertainty of the business environment, such as the timing of open access and potential privatization in Ontario and the implications of merger and acquisition activities in the neighbouring U.S. jurisdictions.

The study group did not make a distinction between the configurations under this criterion and objective.

One approach to an assessment was to consider how generation entities would respond to uncertainties, such as economic downturn, competitors or changes in environmental regulations. While these uncertainties may be useful for testing investment decisions of any one entity, they are not helpful for testing the flexibility of generation configurations. In an open and competitive market there are a wide range of risk management strategies available for any entity to employ.

Another approach was to consider establishing a holding company for Ontario Hydro with a multi-business model. If that was done, then which configuration provides the most flexibility for allowing further disaggregation and divestment of generation entities while at the same time allowing for possible re-aggregation of generation entities to maintain competitive advantages and market power? By definition, the holding company structure provides the flexibility -- the only distinction among the six configurations is that Configuration 2 would fit into the structure most expediently because it is close to the current configuration, but for independence. However, as it is the holding company that provides flexibility no overall distinction among the configurations is made.

SUMMARY OF ASSESSMENT RESULTS

The purpose of this study was to assess and evaluate the performance of generation configurations in meeting objectives. It is not the purpose of the study to make trade-offs among objectives in order to recommend one or more generation configurations. Therefore, the table below summarizes the assessment results by objective and indicates the performance of a configuration against an objective as 'high', 'medium' or 'low'.

Objective	Configurations					
	Fully Integrated	Technology Integrated	Consolidated hydroelectric and fossil	Consolidated fossil and nuclear	Fragmented H & F; Consolidated nuclear	Fragmented
	1	2	3	4	5	6
Maximize asset value	high	medium	medium	high	medium	low
Increase efficiency	medium	high	high	high	medium	low
Increase customer choice	low	high	medium	high	high	medium
Increase competition	low	medium	medium	medium	high	high
Improve competitive position	high	medium	medium	high	low	low
Provide flexibility	=	=	=	=	=	=

Note: "=" means no distinction between the configurations was made; refer to the flexibility assessment.

Three questions were posed at the out set of this study. The questions and responses follow.

1. What generation configurations best meet selected objectives of restructuring Ontario's electricity industry?

No single configuration best meets all objectives. However, as a general observation of the summary of results table above, configurations with larger entities (Configurations 2, 3 and 4) consistently perform well over all number of the objectives.

One of the key objectives for restructuring the electrical utility industry is the introduction of competition, in particular the introduction of competition in the generation sector. Generation configurations can enhance this competition within the generation sector. The choice of a generation configuration will be governed by trade-offs between a number of competing objectives.

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The Amount of Market Discipline

Market discipline results from customer choice and competition.

In general, a large number of small generation entities will be subject to more market discipline than a small number of large entities. They will have less market power and be under more pressure to control costs and to be creative in offering customers as much choice as they demand.

However, it is a question of degree. There is a significant degree of market discipline imposed by allowing open access into the Ontario market through the 4,000 MW of interconnection capability. In addition, prices will be constrained by the costs of a new entrant into the market. These two disciplines exist, whatever the configuration of generation in the Ontario market.

Ultimately, the prices in Ontario and in the interconnected market will approach the costs of a new entrant as the amount of surplus generation in the interconnected systems are reduced by retirements or by new load growth. This too will occur whatever the generation configuration.

Customer choice, competition and market prices will also influence capital investment. Under the regulated, cost recovery based regime of the past, the costs, benefits and risks associated with generation asset investments are born by the customer. Introducing competition in the generation sector results in transferring the costs, risks and benefits associated with generation asset investments from the customer to the investing shareholder. The costs, benefits and risks of the generation assets belong to the investor. In the longer term, it is expected that the competitive markets forces will bring a discipline to the asset investment process that was not achieved through the cost recovery regulatory process.

The Market Value of The Generating Assets

If the market is configured with many small players the ability of the players to recover average costs decreases and prices could collapse to values close to the marginal running costs on the interconnected system. Such a configuration would reduce the market value of the generating assets, which would be strongly influenced by the near term outlook for revenues.

In addition to the fact that small companies have no market power, there are economies of scale and benefits of integration, which make the whole worth more than the sum of the parts (see below). If generation entities are configured without market power and are too small to be economically sustainable in the long run, reaggregation will likely occur through acquisitions, mergers and buyouts in order to capture efficiencies and market power for competitive advantages. The beneficiaries of this could be larger, more economically efficient entities in neighbouring jurisdictions. This conglomeration is already occurring in the U.S., with mergers typically resulting in generating companies of 9,000 to 17,000 MW.

The Benefits Of Integrating Within And Among Generation Technologies

Some of the integration benefits are:

- Coordinated operation of generation
- Improved ability to coordinate the operation of thermal and energy limited hydroelectric resources
- Improved ability to optimize fuel inventories
- More negotiating power with suppliers of fuel and services
- Coordinated maintenance scheduling
- Shared technical expertise
- Reserve sharing
- Financing - a large entity is better able to afford capital investments and to secure better terms in financing them.
- Planning
- Coordinated and shared marketing

These benefits must be weighed against the increased market discipline imposed by having more competitors.

2. How do generation configurations perform under different market structures or market areas?

The response to this question is addressed in the interaction between the number of players in the market, the degree of access these players have to the market and the market rules (regulation) guiding these interactions. In just an Ontario market area, with limited access by external participants, the greater the number of players the greater the opportunity to invoke competitive market forces. And with several players, the generation entities are small. However, as the market expands to include larger and larger sections of the Eastern Interconnection (northeastern North America) as a result of open access, these several small players can be driven out of the market by predatory practices of larger players with stronger financial resources.

However, the larger the entities the greater potential for exhibiting market power in the smaller Ontario market. The balance in configuring generation for the future market has to be struck based on market power exhibited by larger entities in the smaller transitional market (Ontario) and the ability of these entities to survive in the larger market. This balance can be struck through the market rules (regulations) that govern this transitional period. As Ontario becomes a part of the larger integrated market in the Eastern Interconnection. The ability of generation configurations within Ontario to influence the achievement of certain objectives is diminished.

The analyses of this study have all been qualitative. Further work is required to better understand and quantify, where possible, the interactions of generation configurations and markets.

3. What configurations allow flexibility for responding to shifting emphasis among objectives over time?

No distinction is made among the generation configurations and their ability to allow flexibility. All generation entities in any of the configurations will have a wide range of risk management strategy options in an open access environment. If a holding company was to be established for a transitional period (i.e. monopoly in generation to a competitive structure), then it is the holding company itself that provides flexibility, not the generation configuration.

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APPENDICES

APPENDIX A *Benefits of fuel and technology integration*

Nuclear

Ontario's generation sector is unique in North American because of the amount of nuclear generation. No other jurisdiction in North America has such a dominance of one technology in a market area. By capacity, it represents about 40% of Ontario's generating capacity and about 65% of Ontario's annual electricity energy needs. The nuclear technology is CANDU; Ontario has 19 operating units and there is one CANDU unit in Quebec and one in New Brunswick - there are no other CANDU units in North America.

Splitting the existing nuclear entity to help form competing generation entities in Ontario may result in a loss of integration and economies of scale in a number of areas. Examples of integration and benefits of nuclear remaining whole are:
- sharing of knowledge, research and engineering solutions to problems that affect the performance of units such as pressure tube life management and replacement; water chemistry and metallurgy knowledge for steam generator life management; inspection and maintenance teams shared among all units;
- training of licensed staff and maintaining training facilities that simulate station operations;
- benchmarking among all units and stations identifies opportunities for cost reduction; and
- providing focused support for the human resource and physical assets through a board of directors and senior management team committed to excellence in safety and performance. The new company could be positioned such that all its employees would see their future being within their control by demonstrating to future investors successful performance on safety, environment, energy output and costs.

Findings from a comparison of the best performing nuclear stations in the world, based on cost, safety and operational performance, show advantages of size i.e. owning several stations, particularly multi-units stations.

As a result, many people conclude nuclear generation ought to be operationally whole. Other generation companies owning a portion of the nuclear entity so that market power cannot be exercised by one dominate player is an option. However, there may be difficulty with the perception that collusion among the owners is possible, especially if nuclear performance is poorer than expected in an open access market with competition for market share.

Another consideration for keeping the nuclear group together is the potential to form 'Nuclear Electric Canada'. Nuclear Electric Canada would be a merger of OHN and those parts of AECL that directly support CANDU technology. This new entity would have the resources for improved integration of R&D to support and improve nuclear performance in Ontario (which has immediate and significant payback; 1% on average annual capacity factor, a measure of operating performance and production levels, is equivalent to about 40 M$ in revenue) and to leverage design and operating experience to grow the CANDU business in international markets. This would provide economic benefits for Ontario and Canada. If nuclear generation is divided among different owners the opportunity to form Nuclear Electric Canada is likely foregone.

Fossil

The efficiency of operating Hydro's fossil fuelled generating stations is enhanced by integrating fuel supply, inventory management and utilization as well as coordination in the planning and execution of plant

maintenance. It is unlikely that these efficiencies could be duplicated by operating the fossil plants as independent entities.

Fuel Management

There would be an increase in the cost of fuel management for operating Hydro's fossil generating plants as separate entities. Competitive leverage, particularly in coal supply and bulk transportation markets, would suffer significantly in desegregated operations, such as in Configurations 5 and 6. Additionally, keeping fossil assets in the same generating portfolio will exploit the advantage of Hydro's reputation in coal markets.

Fuel inventories are maintained to accommodate uncertainty in the demand for generation. For coal plants, additional inventories are maintained to account for wet or frozen portions of the piles which might be temporarily unusable during winter and spring. Inventory management is a significant variable This seasonal build-up in inventory is exacerbated at Lakeview, Lambton and Nanticoke where fuel supply is suspended until the waterways reopen in the spring. Integrated plant operations provides the facility to spread the associated risks, thereby reducing the overall level of this inventory. Similarly, the ability to divert coal from one plant to another provides the facility to share inventory and increase operating flexibility. For instance, in the winter of 1995 the operation of Lambton unit #1 was made possible by redirecting coal which was earmarked for Nanticoke, thereby optimizing purchase commitments and saving on the expenditure for coal.

The infrastructure for fuel delivery is rendered more effective by multiple delivery points in an integrated fossil fuelled operation. The multi plant characteristics of the existing fossil system can sustain dedicated vessels which increases the flexibility and efficiency of the fuel program. This effectiveness of the delivery system is facilitated by the scale of Hydro's operation. The associated economic benefit of an integrated operation will be difficult to maintain if the size of the program is reduced through fragmentation of the fossil system.

Maintenance

There are considerable economies of scale from the coordinated planning and execution of maintenance for generating plants with the same technology. A portfolio which includes Hydro's six fossil fuelled plants permits the synergistic organization of work to monitor and repair plant equipment. The maintenance of these plants as separate entities would require considerably more of the skills that are used in the integrated operation. For example, maintenance for Hydro's fossil plants is scheduled to minimize the use of resources required to sustain economically optimal plant availability. There are also savings from applying processes for maintenance and operation across plants with the same characteristics and design features. As an integrated these plants are linked through systems for monitoring and controlling

Emission Management

The operation of an integrated fossil fuelled generation company in Ontario provides more flexibility and administrative efficiency in managing gas emissions than is attainable from the operation of fossil generating plants as separate entities. These benefits are realizable under either emission limits or emission trading regimes.

Hydro has the able to manage acid gas emission from fossil plants by shifting generation between plants. This shift in generation is defacto emission trading, which could not be replicated in independent operation without transaction costs. A desegregated fossil system may compromise the trade-offs available from a multiple plant structure and may require plant specific limits, which would reduce overall capability.

Hydroelectric

Water resource management and regulation

The integration of water management activity is most effectively done on a province wide basis. There are so many interested groups affected by water management decisions (i.e. federal, provincial and municipal governments; citizenship & public groups; First Nations) that any disintegration of unified activity could be counterproductive. The needs of these groups are currently accommodated on both a regulatory and voluntary basis. With smaller hydroelectric groups, as in Configurations 5 and 6, some of these voluntary activities would not be conducted or would cost more. If these activities are not undertaken, there is the risk that the province would move towards a more stringent regulatory approach. A regulatory approach not only means increased costs (additional monitoring for compliance, legal fees, studies), but if operating water levels are further constricted it would mean lower production levels and lower revenues with a negative impact on the Ontario consumer. It is a cost / benefit decision but the end result for either option will be higher costs. As an example of increased costs from regulation, New York Power Authority is paying approximately $30 million for St. Lawrence River relicensing (conversely their annual water rentals are not as high).

The Tennessee Valley Authority (TVA) has reinforced the need for integration of water management activities by establishing one group that oversees these interests. The water management group is a division of TVA split from the main organization and is partially funded by the government. The group manages the watersheds and instructs the stations on how to run the water - stations have limited control over their fuel and operations and therefore their financial results. Similarly, the Ontario government may be willing to create a Water Management Group that will amalgamate current government water functions with Ontario Hydro water functions. The main disadvantage with this alternative is the limited potential for maximizing revenue for the investor through operations and consequently lower market value of hydroelectric assets.

For other initiatives, such as, water rentals, negotiations conducted on a provincial basis have the advantages of a greater influence over government decision making, a more proactive environmental / citizenship stance and improved consistency in managing watersheds and between watersheds. With hydroelectric stations split into multi business units, in order to create a level playing field amongst all hydroelectric companies, the government will dictate water rental rates and there will be no opportunity to influence policy.

Fuel management

Due to the cascade effect of water and the interrelationships between stations on a river system, if hydroelectric plants were split into competing business units, it must, as a minimum be on a watershed basis. Inefficiencies of uncoordinated water utilization are estimated to be as high as 1 TWh based on different storage management objectives, differing station sizes and storage capability on a river and poor outage coordination all resulting in spill. In general the lack of storage capability implies a reduction in energy prices to ensure sales. The value of this energy is estimated between $25 and $50 million annually.

Safety programs

The Dam Structural Assessment Program is based on voluntary compliance. Private hydroelectric stations do not follow the same stringent, program guidelines as government regulation does not exist. In an entity with a mix of generation, and hydroelectric facilities divided among them, a cost / benefit decision and risk assessment would lead to either this program being continued but without the benefits of integration, increased regulation or the acquisition of liability insurance in the event of a dam or structure failure. All result in higher costs.

Special products

As one entity, the Hydroelectric Business Unit currently supplies most of the ten minute operating reserve for the province for system control and response - a NPCC / NERC requirement to maintain the integrity of the entire North American interconnection. A split of hydroelectric stations, as per Configurations 5 and 6, would increase the response time to achieve the ten minute operating reserve requirement which would comprise the quality, and increase the cost of this product.

Support Systems

Similarly, to fossil and nuclear technologies, there are economies of scale that apply to the hydroelectric group as one entity, such as, coordination of maintenance work, reliance on diverse experience in solving problems, information systems, engineering solutions , engineering & quality control standards and environmental support. As a smaller entity, the hydroelectric knowledge base to solve problems will not be as effective and the ability to resource fluctuating work programs at different stations will not be as efficient.

SED

Hydroelectric generation is a renewable resource in contrast to fossil or nuclear generation which are finite resources. Future opportunities exist for creating a renewable market niche and pricing 'green' power at a premium. Ontario public opinion surveys indicate that over 50% of consumers surveyed would be willing to pay a premium for energy from renewable sources. Various US utilities are successfully implementing Green Pricing programs (i.e. SMUD, Colorado PSC, Traverse City Light and Power, Southern California Edison). As a mixed fuel entity, customers could not be guaranteed that their power would be purchased from an environmentally friendly resource.

APPENDIX B *The nature of competition to supply customer demand*

Meeting the load

For a substantial fraction of the year, Ontario has a constant demand for electricity that amounts to about 14,000 MW (see Figure B-1). To supply this base load Ontario historically adopted a high capital but low fuel cost strategy for generation supply facilities.

The Niagara River and St. Lawrence River generators dominate the hydroelectric contribution to base load supply (about 3,000 MW and 20 TWh/a energy production) and they have low running costs of about 1 $/MWh. Ontario Hydro Nuclear is the other base load supplier with about 13,500 MW in-service and about 85 to 90 TWh/a of energy production. The nuclear facilities also have running costs of about 2 $/MWh). In any market these facilities will run, so long as they are able, because of their low running costs. Their fixed costs, which in the case of nuclear is high (or would be even if divested), does not change this fact. Essentially, no one can meaningfully compete to supply the base load portion, area 'A' in Figure B-1. There is a small amount of competition when there is more base load capability than needed. Currently this happens up to 20% of the time over a year, but is for supplying about 3 TWh out of approximately a total base load energy demand of 120 TWh annually.

Price setters and price takers

The generators at the margin ('B' of Figure 1) are the 'price setters', who determine the spot market price for electricity, which in turn influences the contract market prices. For the most part this is where competition takes place. In this area generation running costs reach over 20 $/MWh.

The base load generators are 'price takers'. Basically, because of their fixed cost characteristics, base load generators cannot afford to be idle and for the most part they will bid into a market at a price level that ensures they do run (e.g. they can bid '0'). The generators will then take whatever price is set by the marginal unit, or if they do happen to be the marginal unit, they will bid just below that of the next marginal unit in the economic loading order. While the base load generators may not compete to run, they do compete to get the best (i.e. highest) price.

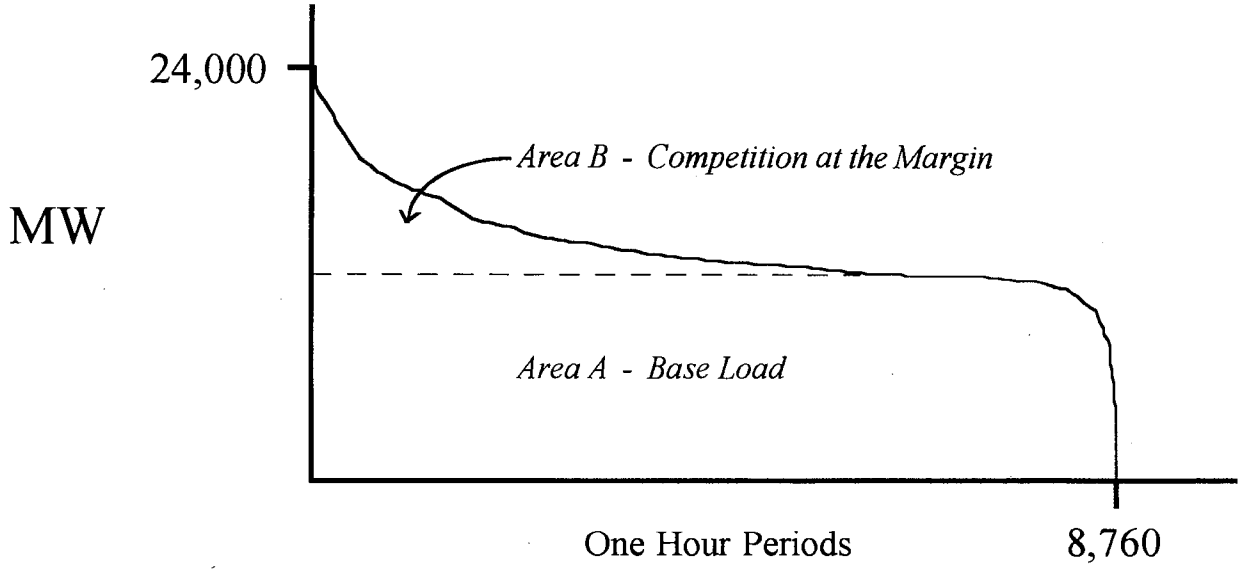
Any generation entity, especially any that have high fixed cost recovery requirements, would want to have price setting units, or buy out and remove from service certain units so that it can influence market prices upwards. Depending on the market rules, this would included entities outside Ontario.

On the other hand, some customers (or agents on behalf of customers e.g. a public price averaging pool) would want price setting units so that they could cap or influence market prices downwards. Generally, the cost of installing and running a combustion turbine unit provides a price cap.

One exception to the assertion above that low running cost base load units must run is that a base load entity may at times hold back a unit(s) in order to drive up the market price if there is a significantly higher cost unit waiting next to run on the margin. They may do so when the loss revenue associated with the withheld unit(s) is more than made up by the higher revenue earned on the remaining operating units. In such circumstances, called "gaming", customers and the environment may not be best served.

FIGURE B-1

Provincial Load Duration Curve*
(illustrative)



* A load duration curve illustrates the number of hours in a year that an aggregate level of customer demand existed. It takes the peak load in each hour of a year and plots these loads from highest (left side) to lowest (right side). Base load is that level of demand that exists year round or nearly year round.

Transmission constraints

Transmission constraints constrict the physical flows of electricity from one region to another and therefore can allow generation resources on one side of the constraint to command higher prices. However, this would create the opportunity for new entrants to locate in the higher cost region if they can offer lower prices. If the original generation is high cost it will be exposed to competition; if it is not it may be able to avoid direct competition by pricing its products such that new entrants cannot quite risk the investment.

Would Customers tend to contract with close generators rather than distant generators?

Cost and reliability could result in customers tending to contract with generators that are electrically closer to them over generators that are more electrically distant.

Customers have to pay to have their electric products delivered to them over the transmission and distribution system. Under the current system, the customer pays for transmission services on a postage stamp basis, that is, the price is the same per unit delivered regardless of the customer's location in Ontario with respect to location of the generator. Under open access, pricing of transmission and distribution service will be based on electrical distance for reasons of transparency of cost and equitable treatment. As a result, a customer will have to pay more to have comparable electricity products delivered from electrically distant generators than they would from those generators that are electrically closer.

Customers also value reliability. A significant component of reliability for the electricity customer is the reliability of the transmission and distribution system. Depending on the backup power arrangements the customer has available to cover interrupted delivery, customers will tend to contract with generators that are electrically closer in order to improve their reliability of delivery.

Consequently, in the contract market, the market value and profitability of a generation entity could depend on its location to customer load.

Interconnection capabilities

From Ontario To	Summer limit MW	Winter Limit MW	Summer Limit MW	Winter Limit MW	To Ontario from:
Michigan	2300	1740	1740	2230	Michigan
New York	1900	2450	1000	1600	New York
Quebec	400	400	1200	1200	Quebec
Manitoba	200	200	200	0	Manitoba
Minnesota	150	150	100	50	Minnesota
Total (U.S.)	4350	4340	2840	3880	total (U.S.)

Generation reserve for reliability

Because of the high value customers place on reliability, generation entities that have contracts to serve customers (or an obligation to serve customers) must carry reserve capacity, either as excess physical plant or contracts with others for back up. An entity without generation reserve would have the value of its product

discounted and earn less revenue. Alternatively it could simply supply a spot market, taking what price it gets as and when it generates, which may present an unpredictable revenue stream, depending on the rules of the market.

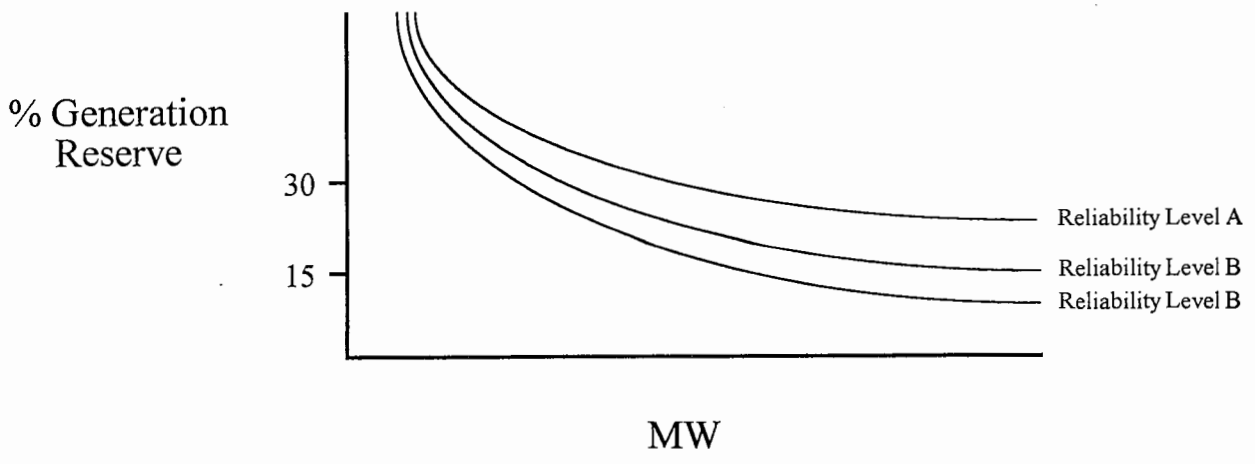
Generation entities acting as agents for customers that compete for market share will carry generation reserves. For a given level of reliability a smaller generation entity has to carry a larger fraction of generation reserves (see Figure B-2) compared to a larger entity. Reducing generation reserve carrying costs has historically been one reason for large utilities, such as Ontario Hydro, and the power pools that several utilities supply in the U.S.

Consequently, forming smaller generation entities that compete for market share could lead to more excess physical plant being acquired sooner rather than later. For example, OHN as a separate entity on its own would want to have back up contracts for reliability so that it can confidently contract with customers. Potentially, OHN would be contracting with competing generation entities for such back up, which raises interesting questions on costs and willingness of competitors. Alternatively, OHN could acquire its own back up generation such a gas-fired combustion turbine units, and may do so by mergers and acquisitions or new construction.

The need to provide generation reserve may drive reaggregation into larger entities if small generation entities are created initially.

FIGURE B-2

Generation Reserve for a Level of Reliability
(illustrative)



APPENDIX C

Ontario Hydro generation data and other market players

Market players other than Ontario Hydro

Existing NUGs

Ontario Hydro has contracts with non-utility generators (NUGs) that total about 1,500 MW, providing about 11 TWh of electrical energy annually. For the most part these NUGs are 'must run' contracts and therefore they do not compete to run. If the move to an open market results in stranded investment payments to Ontario Hydro then it may be possible to negotiate bilateral agreements with NUGs that provide similar stranded investment payments in exchange for their earlier participation in a competitive electricity market.

Existing customer and other Ontario utility generation

Within Ontario customer self-generators and other utilities (e.g. Great Lakes Power, Orillia Light and Power) have a combined capacity of about 1,500 MW producing about 6 TWh of electrical energy annually. Under open access these generators and utilities could bid their energy production or surplus energy production into the central market operator. However, because most of these generators are small, their ability to compete by being a marginal unit is limited. Nevertheless, collectively they present an influential competitive threat to existing generators because they effectively take away existing market share. And as new self-generation opportunities arise, the impact on market share can be increased if they over-size they generating capacity needs and sell surplus generation at marginal or just below market clearing prices.

Interconnections to Manitoba, Quebec, and U.S.

Interconnections between Ontario and neighbouring jurisdictions provide a potential capacity of 2,500 MW to 4,000 MW and an annual energy exchange potential of about 15 TWh. Currently, the typical cost of electricity over the interconnections is about 25 $/MWh to 45 $/MWh, depending upon the delivery conditions e.g. interruptible power or firm power. Interconnections can provide competition on the margin and both a price floor and a price cap. For example, generally the marginal units in Ontario would not bid energy into the market at prices below what the competing interconnections can provide to earn the highest revenues, and would not bid above what the interconnections can provide to not loose sales volume.

Depending on the market rules, the interconnections allow generators, aggregators, marketers and brokers outside Ontario to compete for market share within Ontario; and they allow Ontario generators, aggregators, marketers and brokers to compete for market share in other jurisdictions.

New Entrants

In an open access industry new entrants would have equal access to transmission and distribution facilities and customers. There is no limit on the number or timing of the new entrants. New entrants may enter at any time to compete for existing market share or for new capital investment.

New entrants may also compete through distributed generation where local opportunities exist because of transmission constraints, district energy applications, and new technologies (and available fuels) which allow smaller generation applications. For example, a highly distributed form of generation that would radically alter

any generation configuration established today would be something in a residential basement producing electrical and heat energy.

Customer Agents (Aggregators, Marketers, Brokers)

Retail open access allows customers to choose their supplier. A generation entity may act as an agent for a customer; the Price Averaging Pool would act as an aggregating agent for many customers who choose to remain with it; marketers will arrange contracts with one or more generators in order to meet their aggregated needs that have been built through a number of customer contracts; and brokers may arrange deals between large customers, generators and marketers. These agents will make the best use of all generation entities available to them; Ontario Hydro generation; NUGs, customer generators, other Ontario utilities, and utilities on the other side of the interconnections. They may also use financial instruments to hedge the prices for with they have contracted.

Ontario Hydro Generating Station\River System Descriptions

Hydroelectric Business Unit

Group	River Systems	Typical ACF	Capacity (MW)	In-Service Capacity (MW)	Typical Energy (TWh/a)	Average Age (years)
1. Niagara	Niagara	Base-loaded	1,955	1,955	12.9	50
	Welland Canal	Peaking / Intermediate	275	275	0.3	58
		TOTAL	2,230	2,230	13.2	51
2. Central	Beaver	Base-loaded	1,004	1,004	7.1	39
	Muskoka	Peaking / Intermediate	44	44	0.18	76
	Otonabee					
	Severn					
	St. Lawrence					
	Trent	TOTAL	1,048	1,048	7.3	40
3. Ottawa	Madawaska	Base-loaded	242	242	1.4	55
	Matabitchuan	Peaking / Intermediate	1,529	1,529	4.8	39
	Mississippi					
	Montreal					
	Ottawa					
	Rideau	TOTAL	1,771	1,771	6.2	41
4. Northeastern	Abitibi	Base-loaded	6	6	0.0	81
	Mattagami	Peaking / Intermediate	1,448	1,448	5.3	39
	Mississagi					
	South					
	Sturgeon					
	Wanapitei	TOTAL	1,454	1,454	5.4	39
5. Northwestern	Aguasabon	Base-loaded	575	575	3.6	51
	English	Peaking / Intermediate	48	48	0.2	36
	Kaministikwia					
	Nipigon					
	Winnipeg	TOTAL	623	623	3.9	50
TOTAL		Base-loaded	3,782	3,782	25.0	47
		Peaking / Intermediate	3,344	3,344	10.9	41
		TOTAL	7,125	7,125	35.9	44

Ontario Hydro Nuclear

Station	Capacity (MW)	In-Service Capacity (MW)	Typical Energy Potential (TWh/a)	Typical Annual Capacity Factor (%)	Age (a)
Pickering A	2050	2050	15	65 to 80	~22
Pickering B	2050	2050	15	75 to 85	~10
Bruce A	3100	2325	20	60 to 80	~20
Bruce B	3400	3400	23	75 to 90	~10
Darlington	3500	3500	25	75 to 90	~4
Relevant Totals	14,100	13,325	80 to 95		

Fossil Business Unit

Station (& Location)	Capacity (MW)	In-Service Capacity (MW)	Age (a)	Fuel
Lakeview (Mississauga)	2280	1140	~30	bituminous U.S. coal
Lambton (near Sarnia)	2100	1575	~28	bituminous U.S. coal
Nanticoke	4340	4340	~24	bituminous U.S. coal
Thunder Bay	320	320	~10	lignite western Canada coal
Atikokan	215	215	~10	lignite western Canada coal
Lennox (near Kingston)	2230	1115	~20	residual oil
Relevant Totals	11,500	8,700		

APPENDIX C

SED and Competitiveness

18 December 1995

SED AND COMPETITIVENESS

The objective of sustainable energy development (SED) is the most efficient and productive use of energy, human, financial, and natural resources. A more resource-efficient and environmentally progressive electricity (energy) system will reduce costs and increase competitiveness for Ontario and its power sector.

It has become clear that the relationship between the two objectives - competitiveness and sustainability - is not only compatible but synergistic. Ontario Hydro's need to continuously reduce costs, for example, compels the company to look for greater efficiencies in resource use and re-use through innovation. At the same time, the commitment to sustainable development also enhances the development of vital business skills that contribute to customer satisfaction and profitability: innovation; strategic investment; alliances; and a more focused sensitivity to the environmental concerns of customers and their communities.

SED is not just an environmental issue but a forceful influence on Ontario Hydro's bottom-line. And although there are already Hydro examples of the relationship between good business and sustainability, there are still gains to be made. Decreased remediation and pollution control costs, reduced maintenance and energy resource expenditures, and rapidly increasing international markets for energy efficiency and environmental technologies are three examples of where business and SED principles regularly converge.

In its SED policy statement, Ontario Hydro states that its near-term focus is on the efficient use of resources, continuous improvement in environmental performance, and diversification of products and services. The major business drivers for Ontario Hydro's SED program are the need to:

- reduce operating costs through resource use efficiency;
- reduce costs or generate revenue through improved business practices;
- be proactive in responding to environmental regulation;
- reduce future environmental liabilities;
- use strategic partnerships to achieve business objectives;
- develop new business opportunities; and
- retain/attract customers.

Economic arguments, however, are not the sole rationale for investing in measures that reduce the impact of Ontario Hydro's activities on the environment and resource base. There are a number of things which Ontario Hydro does in the name of environmental stewardship, such as forestry and wildlife management, because it is the responsible thing to do, even though it is not currently possible to calculate the future cost and benefits of doing so.

Michael Porter and Claas van der Linde, and many others, have recently argued that an inherent positive linkage exists among environmental performance, resource productivity, innovation and competitiveness. They argue that viewing problems and opportunities related to environmental constraints from a competitive and innovative perspective can lead to lower product costs, improved environmental performance, enhanced product or process quality,

greater product differentiation, higher value-added features and improved health and safety performance. They also argue that the regulatory framework needs change to promote innovation as the basis of problem resolution, rather than the traditional command and control approach.

While there is often "low hanging fruit" which organizations can harvest with little effort and discipline, many of the advantages cited by Porter only come through a broadly shared and supported commitment to look at the environment/business interface in a comprehensive and systematic manner. Most benefits in this area will be achieved over the longer term. One of the best, long-term benefits to taking this systematic approach is in developing a workforce that is more sensitive to the opportunities that are available, and routinely and consistently explores avenues for greater integration of environment and business in all of their activities.

Many leading corporations and industry associations are adopting a similar approach to environmental management through the World Business Council for Sustainable Development (WBCSD), the Global Environmental Management Initiative (GEMI), the Coalition for Environmentally Responsible Economics (CERES), and Canadian Chemical Manufacturer's Association (CCMA). Out of these co-ordinated efforts, many new and very promising approaches that promote systematic and innovative lowering of environmental impacts and improving product quality and profitability are being developed and applied across the full spectrum of business sectors. These approaches include: design for environment, cradle-to-grave responsibility, product stewardship, supplier screening, product labelling, material substitution, pollution prevention, waste reduction, full cost accounting, and many other business strategies. Most if not all of these activities offer either cost advantages for the organization or their customers or positively differentiate their products in the market place by delivering higher functionality and thereby improve competitiveness.

When a sustainable development approach was first proposed for Ontario Hydro - even though there was an effective environmental management function in the organization - it was initially viewed as a costly add-on to the core business. Over the last two years, Ontario Hydro has demonstrated that a SED approach is good business; that it can be implemented cost-effectively, and in fact, is integral to our future success. SED initiatives have been integrated by virtually all Business Units in their 1996-1999 business plans. Highlights of achievements which have been realized to date, as well as some planned activities for 1996 and beyond are described below.

REDUCE OPERATING COSTS THROUGH RESOURCE USE EFFICIENCY

Ontario Hydro is a major consumer of energy and other resources. The degree to which improvements can be achieved in production, conversion, and delivery processes offers tremendous opportunity to lower unit energy costs, improve the ability to compete on price, deliver a higher level of service to our customers, and simultaneously, reduce impact on the environment.

Ontario Hydro is advocating an "eco-efficiency" approach to its energy service activities - adding value to products and services, while continuously reducing energy and material inputs, pollution, and waste. Benefits of this approach go right to bottom line - reducing wasteful practices, making more product available to customers, and increasing revenues for the company.

(a) Internal Energy Efficiency

An example of this approach is Ontario Hydro's recent savings in its in-house use of energy. Ontario Hydro's year-to-date (October 31, 1995) energy efficiency and process conversion efficiency improvements total 680 GWh which has a corporate value of about $37 million. In 1996, an increasing focus of this program will be on thermal conversion efficiencies.

One example of a successful in-house energy efficiency program is the lighting retrofit of the 700 University Avenue head office complex. In 1994, motion sensors and T-8 lighting (a new lighting technology which uses less electricity, requires fewer fixtures, gives off less heat, and produces more natural lighting) were installed throughout the Ontario Hydro Head Office complex. This retrofit resulted in:

- a 29% reduction in annual electricity use, at a savings of at least $500,000 per year;
- installation was done at no additional cost to Ontario Hydro (The project will be paid from the savings realized. The payback period for the contractor will be about four years);
- no modification was needed to the building design at 700 University Avenue as a result of lower heat output. (This building is designed to recover and re-use heat generated by people and equipment. Sufficient heat was available from other sources such as personal computers to heat the building.);
- an unexpected security benefit from the motion sensors, particularly in the evening hours when some, or all, of a floor are in darkness; and
- a further environmental benefit in that all the old light fixtures were disassembled and re-cycled.

In another example, staff at Erie-Niagara Utility are installing shunt capacitors on 15 lines in their area, at a cost of about $250,000, to reduce peak line losses (kW) and line energy losses (kWh). Traditionally shunt capacitors were used to address voltage problems on transmission lines but a recent feasibility study confirmed that they could also substantially reduce line losses. Annual savings in this utility of about 500 kW or about $81,000 are expected, assuming average weather conditions. This would mean a three-year payback for this project, but the savings province-wide could be more substantial, in the range of 50 MW annually, and $8 million.

(b) Cost Accounting Improvements

A pilot project is underway in Southwest Hydro Utility to identify its internal environmental costs. The purpose of the pilot is to better identify where environmental dollars are being spent and to assess whether the expenditures are achieving the environmental gains expected, in an cost-effective manner. It is expected that this pilot will highlight some cost savings opportunities in improved materials management and waste management practices, as well as possible revenue opportunities. A similar internal environmental cost pilot is proposed in GRID in 1996, as part of its work on Activity-Based Costing.

REDUCE COSTS AND GENERATE REVENUE THROUGH IMPROVED BUSINESS PRACTICES

Continuously improving business practices will be key to achieving environmental leadership and maintaining competitiveness. Efficiency is the key driver in the pollution prevention and waste reduction initiatives being pursued by Ontario Hydro. Materials previously viewed as wastes, are being re-cycled/re-used as inputs to other industrial processes (i.e., industrial ecology), often at considerable savings. In many cases, these initiatives have provided additional revenue sources for the corporation.

By-product utilization offers an environmental benefit by avoiding the resource use and pollution associated with raw material extraction, manufacturing, distribution and use of products within our economy. By-product re-use initiatives being pursued as business opportunity include the work underway in investment recovery, fly-ash, gypsum, and calcium carbonate.

(a) Investment Recovery Opportunities

The 3Rs (reduce/re-use/recycle) are being integrated into Ontario Hydro's business practices. The Kipling Waste Transfer Facility recovers metals and equipment for re-sale and handles hazardous and non-hazardous waste from sources across the corporation. The facility tests, characterizes, stores, and disposes of the waste to either receiver sites or processes for reclamation, recycling, landfill, or incineration. The facility is licensed to receive most regulated wastes and is licensed as a PCB storage and transfer station.

Investment Recovery at its Kipling Waste Transfer Facility realized a total sales volume of $27 million in 1994 for material sold in bulk (e.g., scrap metal, surplus materials, equipment). Revenues of $23 million were returned to the business units. The costs of running this facility are approximately $4 million.

Investment Recovery is also pursuing strategic partnerships with Municipal Electric Utilities (MEUs) to consolidate and manage both Ontario Hydro and MEU waste, thereby increasing volumes, reducing per unit management costs, and providing a service to our customers.

(b) Gypsum and Fly Ash Wastes as New Revenue Streams

Sale of gypsum, a by-product of the flue gas de-sulphurization (FGD) process at Lambton GS, to Westroc Industries Limited resulted in competitive advantages for both companies. Westroc was able to shut down its high cost underground gypsum mine and reduce its cost of production. Ontario Hydro not only eliminated all waste management associated with FGD, including waste hauling and landfilling, but also sells the gypsum produced at the station. An additional benefit of this contract is that Westroc now produces wallboard which is 100% recycled gypsum and paper.

More than 90% of the fly ash produced by Thunder Bay GS is sold as cement replacement for mine backfill and ready mix production. The revenues produced from the sales of ash are substantial; the station had a net positive cash flow for fly ash management even when the fly ash utilization rate was below 90%.

These ash sales have the added benefit of reducing greenhouse gases by displacing the CO_2 generated from cement production by almost one tonne for each tonne of fly ash sold.

c) Reducing Landfill Costs

Wood chips generated from line clearing or tree-trimming activities of Retail Utilities were previously sent to landfill. Of the 17,310 tonnes of wood chips generated in 1994, over 98 percent were sold or given to customers and nurseries. Cost savings of approximately $850,000 were realized from reduced tipping fees.

(d) Sale of Calcium Carbonate Solids

Staff at Darlington Nuclear Generating Station (DNGS) are now recycling calcium carbonate solids that originate from the station's De-mineralized Water Pre-Treatment process. During this process, lime (CaOH) and a coagulant are added to water from Lake Ontario. The product, wet sludge, is de-watered to form calcium carbonate solids. Discussions with St. Mary's Cement were initiated to determine if they were interested in the solid as feedstock for their process. Sample results showed that they were easily mixed with raw feedstock and were found to be essentially equivalent to certain classes of limestone.

On December 21, 1994, DNGS sent its first shipment of calcium carbonate solids to St. Mary's Cement. The solids will be utilized as a raw product in the cement-making process. The shipments provide the following benefits:

- diversion of an estimated 350 tonnes of solids from landfill per year which saved an estimated $100,000/year, by avoiding transportation/landfill costs; and
- improved relationship with St. Mary's Cement Company and the neighbouring community.

BE PROACTIVE IN RESPONSE TO ENVIRONMENTAL REGULATION

Ontario Hydro's SED approach promotes meeting environmental regulations as a minimum requirement, but advocates doing more than just meeting regulation. The focus is on being proactive with respect to environmental regulation, rather than reactive. Ontario Hydro's strategy is to:

- look for pollution prevention opportunities rather than the end-of-pipe solutions which are often more costly;
- pursue voluntary actions to meet emission/effluent standards in order to manage the costs, process changes, and time frame more effectively than having the government prescribe the regulation in terms of control technology and the time frame;
- consider market-based mechanisms, like emission reduction trading programs which generally give business more flexibility in achieving government-established emission standards in a more cost-effective manner than installing costly emission control technologies.

(a) Bruce Nuclear Power Development (BNPD) Laundry Facility

The BNPD laundry facility is an example of how a pending government regulation to phase-out the consumption of ozone-depleting substances by December 31, 1995, resulted in the staff taking a proactive approach to their problem. Ontario Hydro used CFC-113 (an ozone-depleting solvent) to dry clean radioactive protective clothing at its nuclear facilities. In 1989, Hydro's emissions were approximately 31,000 kg per year from cleaning 1.5 million kg of neoprene and cotton clothing. The releases were from two main sources: when removing the clothing from the machines and solvent trapped in the voids in the neoprene suits.

With the phase-out of CFC-113, there were several problems: alternative solvents were not compatible with neoprene; other less aggressive solvents could not de-contaminate the clothing; and other alternatives (new water washing systems) were too expensive (approximately $32 million) . The solution which staff arrived at was to pre-screen the clothing for radioactivity to determine if it was clean and to re-design existing facilities to accommodate water washing in conjunction with the active liquid waste systems within the stations. The results of the project were as follows:

- customers needs were met with zero CFC emissions;
- approximately $350,000 per year was saved in avoiding the use of the CFC solvent;
- capital costs were reduced from an estimated $32 million to $1.4 million;
- by pre-screening the clothing with an Hydro-designed detector, the amount of protective clothing requiring dry cleaning was reduced by 99% (1% of the clothing is still dry cleaned with PERC (perchloroethylene) solvent); and
- employee involvement has also meant tremendous improvements in the functionality, ergonomics, and efficiency of the laundry facilities which has improved morale and worker safety.

(b) Darlington Nuclear Generating Station Waste Reduction Program

In another case, in response to a government objective to reduce waste volumes by 50% by the year 2000, particularly in the Greater Toronto Area, staff at Darlington Nuclear Generating Station (DNGS) undertook to review all their waste management practices. Traditionally, DNGS has treated all solid waste produced in Zone 3 (the most radioactive areas which contains radioactive systems and work areas) as contaminated. This resulted in large volumes of materials being shipped to the BNPD Radioactive Waste Storage Site, located 400 km from DNGS. It was suspected that a significant volume of waste collected in Zone 3 areas was potentially free of contamination. Therefore, DNGS and Scientific Ecology Group (SEG) developed an unique system to allow the re-classification of waste materials collected in Zone 3 areas which are free of contamination. The process is designed with multiple checks and barriers to ensure thorough segregation and monitoring of waste prior to its designation and release as clean. This program has been subjected to thorough review by the AECB, external auditors, interested members of the public and from within Ontario Hydro. It is also backed up by an extensive training program and supported by dedicated staff.

This innovative Solid Waste Management Program, commissioned in 1993, has resulted in a $1 million annual savings in avoided low-level radioactive waste (LLW)

processing and disposal costs. The costs to implement this program and realize these saving were $150,000 in equipment costs and no additional labour costs.

There are also benefits with respect to the relationship of the station with the community. Darlington Nuclear Generating Station recently won the 1995 Award of Merit For Waste Reduction in Durham Region. The program also ties into the Zone 3 LLW program since clean materials from this program can now be re-cycled. These efficiency and cost improvements were achieved by using highly efficient and innovative collection programs, on-site sorting facilities and radioactive monitoring systems.

In 1996, the Ontario Hydro Nuclear business plans to expand the Darlington waste management practices to its other nuclear stations.

(c) NOx/VOC Emission Reduction Trading Demonstration

A further example of innovative response to regulation is Ontario Hydro's response to the 1990 Federal-Provincial NOx/VOC Management Plan. This plan resulted in Ontario Hydro initiating an industry-led effort to explore the potential for emissions reduction trading mechanisms to help achieve the environmental targets of the NOx/VOC Management Plan. A demonstration project to test the feasibility of such an approach is proposed for early 1996. It would involve a transboundary trade between Detroit Edison and Ontario Hydro. Many stakeholders, including the Ministry of Environment and Energy, have been involved in this work to date and their continued involvement is critical to the success of the demonstration.

Ontario Hydro's motivation for emission reduction trading is:

- to reduce the ground-level ozone problem in the Windsor-Quebec corridor in a cost-effective way;
- to avoid costly ($1-3 billion in capital) retrofits of Selective Catalytic Reduction equipment on existing plant;
- to establish a precedent for a managing other emissions in similar ways; and
- to maintain the economic and environmental viability of the Fossil business;

By aggressively pursuing a market-based approach to emissions management, Ontario Hydro may be successful in "influencing the rules" and gaining competitive advantage by pre-empting regulation that would provide little flexibility in meeting environmental targets.

REDUCE FUTURE ENVIRONMENTAL LIABILITIES

Our public attitude research indicates that environmental quality is a priority for customers. They also have high expectations that Ontario Hydro will demonstrate leadership in managing the environmental effects of its operations. Ontario Hydro takes these stewardship responsibilities very seriously. In addition, Ontario Hydro acknowledges that adopting good environmental practices now, will reduce the potential for future environmental costs and liabilities and that this approach is just good business practice.

(a) Externality Research

Even after existing environmental regulations have been met, there are still residual emissions with associated environmental damage. It is Ontario Hydro's view that by better understanding these "residual" environmental impacts that the corporation will be in a better position to reduce future environmental liabilities. It is for this reason that Ontario Hydro is pursuing research on its external impacts and their associated costs. By understanding the external impacts and costs of its operations, Ontario Hydro can be better positioned to respond to tighter future regulations by developing process changes now to reduce its externalities, as well as better managing future environmental liabilities. In 1996, externality research activities will continue in the Fossil, GRID, and Nuclear Business Units and will begin in the Hydroelectric Business Unit.

(b) Environmental Management System

Ontario Hydro's environmental audit program and development of an Environmental Management System standard will not only improve Business Unit management systems and work place procedures, but will also encourage the systematic building of capacity across the organization to raise performance standards and reduce potential liability of the Corporation and its officers. It will also allow for an improved ability to adopt prevention programs that lower costs of compliance and improve business system quality.

(c) Efforts to Conserve and Restore Ecosystem Integrity

Despite environmental assessments and good environmental management practices, Ontario Hydro's activities have caused changes to ecosystems throughout Ontario. Ontario Hydro is seeking opportunities and working with partners, in government and the community, to reduce adverse ecological effects, and make better uses of its lands and waters for achieving regional biodiversity goals. This effort is also focusing on reducing costs of traditional land maintenance activities.

These currently "free" biological resources not only contribute to electricity production, but also support significant industrial (e.g. forestry), commercial, and recreational activities which make a sizeable contribution to the province's wealth. If these biological resources are lost, the loss is permanent. Poor stewardship of these resources will jeopardize current and future economic development in the province, and could result in loss of electrical load and customers.

GRID, for example, is undertaking assessments of lands that have been adversely affected and are investigating cost-effective techniques for either reducing or offsetting effects. For example, GRID is looking at techniques to establish robust, compatible shrub vegetation on selected portions of the right-of-way (ROW) to reduce adverse edge-effects. Long-term costs savings (in the order of 4-7 fold) are anticipated through reduced frequency and intensity of mechanical mowing, thus creating a win-win for both environment and business.
Tall grass prairie relics are also being actively managed for long term survival on sections of our rights-of-way in southwestern Ontario, This is one of the most endangered ecosystems in Ontario and Ontario Hydro is doing its part towards its conservation and long term sustainability. Once established, tall grass prairie is very resistant to woody

plant invasion which helps to significantly reduce ROW maintenance costs. Again, an example of win-win for biodiversity and economics.

Staff at Saunders GS are also naturalizing and re-foresting a site that was formerly grassland. Long-term maintenance costs should be significantly reduced in comparison to annual mowing costs. Numerous examples of reducing routine maintenance costs, while providing important habitats for native wildlife, exist on many of our sites.

USE STRATEGIC PARTNERSHIPS TO ACHIEVE BUSINESS OBJECTIVES

By working through and with others, Ontario Hydro is achieving business advantages and environmental improvements. In one case, Ontario Hydro is exploring business partnerships to use waste heat from its coal-fired generating stations through co-generation. In another case, the forebay at Nanticoke G.S. is the proposed site for a new aquaculture operation. Both are expected to generate new revenue streams for the Fossil Business Unit.

(a) Opportunities for Co-generation

The ability of Ontario Hydro to compete on price will in part be determined by the thermal conversion efficiency of the generation activities. The conversion efficiencies of fossil and nuclear stations are currently 34% and 30%, respectively, on a net basis. Improving conversion efficiencies by 3 to 4% offers the potential to become a lower cost supplier and to be a supplier with lower environmental impacts.

Further, by combining district heat/co-generation with electricity supply, the potential exists to raise over-all station efficiencies to upwards of 90%, as has been demonstrated in Sweden. The sale of waste heat brings in additional revenues, reduces the dependence on fossil fuels that would otherwise be required to heat buildings and reduces water used to condense waste steam in generating plants.

In 1996, Ontario Hydro's Fossil Business Unit plans to make significant improvements to its fuel conversion efficiency, the conversion of fossil fuels to electricity, in part through co-generation. Partnership opportunities are being explored.

(b) Aquaculture Partnership

In 1994, Erie North Aquaculture approached staff at Nanticoke GS with a proposal to establish a fish farm in the forebay. Farmed trout are in high demand from the restaurant business because of their consistent size and reliability of supply. The company obtained a start-up grant from the Ministry of Agriculture, Food, and Rural Affairs and a deal was signed with Ontario Hydro in March 1995. The project involves corralling 14,000 rainbow trout into seven 4 X 8 X 4 foot deep cages, with plans to add an additional 50,000 trout. Larger cages are being planned with a capacity to hold several million trout. The Nanticoke forebay is ideal because of the sheltered conditions and steady currents.

Because the aquaculture project is still in early stages and fish have not yet been harvested, the economic benefits are still unclear. However, this co-operative effort among Nanticoke GS, Erie North, and the Ministry of Agriculture should provide:

- financial benefits to Ontario Hydro as a result of the use of the forebay for a secondary use;
- financial benefits to Erie North Aquaculture through the sale of a new product
- provincial employment opportunities for fish processing and packaging, and
- reduced pressure on the declining commercial fishery.

LOOKING AHEAD: NEW BUSINESS OPPORTUNITIES

Not only does Ontario Hydro need to get the most out of existing facilities, taking into account environmental impacts, efficiency, and costs, but it also needs to be planning for the future. Although Ontario Hydro currently has a surplus of generation capacity, it needs to be looking for new business opportunities. Future generation sources will likely be distributed generation options with low environmental impacts.

(a) Renewing the Hydroelectric System

Ontario Hydro's SHARP program for renewal of hydroelectric stations offers considerable potential to improve output from existing water resources without additional environmental impact to the watershed. An example is the renewal project for the 79-year-old Merrickville Generating Station. This station was brought back into service less than one year after renewal work began to replace its two units with high-efficiency turbines and other equipment. This renewal work has more than doubled Merrickville's capacity to 1.8 MW and increased its revenue-generating capacity by 150 per cent.

This renewal was completed while retaining the heritage features of the site; for example:

- work was carried out from the back of the structure so as not to disrupt traffic on Merrickville's main street;
- exterior walls were braced while interior re-structuring was completed;
- the new high-efficiency turbines were lifted in through the roof, which was due for replacement; and
- the upstream wall was re-built to replicate the original facade.

Outwardly the station maintains the appearance it has had since 1915 when the first unit went into service.

The renewal plan also considered potential impacts on the natural environment and more than 2000 fish were moved before water at the site was eliminated so that work could begin. And, although annual energy output from the station has more than doubled due to the higher efficiency turbines, water levels will remain the same.

(b) Renewable Energy Technologies (RETs) Program

One emerging area of Hydro's business - renewable energy technologies (RETs) - promises to play a major role in helping deliver cost-effective energy services while meeting, or exceeding environmental targets. The RETs Program, approved in 1994, is based on a business case which evaluated the feasibility of investing in the commercial development of methods of generating electricity that offer declining costs, increased

flexibility [through modular design and short lead times], greatly diminished environmental impacts relative to conventional generation, and global marketability.

The objective of the RETs Program is to promote and assist the development and marketplace acceptance of advanced renewable energy technologies. Implementation of the strategy will involve working with a range of partners and stakeholders. The RETs program is also central to Ontario Hydro's strategy for the management of greenhouse gases.

The RETs Program will be implemented in two stages: Stage 1 will run from 1995 to 2000. Stage 1 will pursue a series of initiatives that will lay the groundwork for the long-term success of RETs through technology development, demonstration and gaining operating experience, and commercialization opportunities in niche markets. Stage 2, after 2000, aims to have RETs competing on an equal footing with other energy options. Examples of RETs technologies included in the program are: solar thermal and photovoltaics, wind, micro-hydro, biomass, methane recovery from landfill, as well as technologies for storing and converting renewable energy resources.

Work is well underway implementing the various program elements, including a competitive request for proposal (RFP) for up to 125 MW of grid-connected RETs. A Round 1 RFP was issued to the private-sector RETs industry in 1995 for up to 60 MW of advanced RETs supply. In 1996-97, a Round 2 RFP will be developed for the remaining 65 MW - and will likely be open to the private sector, Hydro business units, and municipal electric utilities.

The RETs Program is also identifying and taking advantage of existing cost-effective opportunities to deploy RETs for in-house (utility) and customer niche applications. For example, the high costs of providing diesel-based generation to remote communities in northern Ontario (at an average cost of 30-40 cents/kWh) provide an attractive opportunity for utilizing RETs for electricity supply. Off-grid applications of RETs (e.g., PV lighting) may also provide cost-effective alternatives to traditional line extensions for both Ontario Hydro and customer electrical service. For Ontario Hydro's business units, these opportunities complement their in-house energy efficiency objectives by reducing need for grid-connected power. For customers, use of RETs can save money, and, at the same time, provide new business opportunities for both Retail and Municipal electrical utilities. In selected areas developing Local Integrated Resource Plans, RETs may also offer cost-effective options to defer construction of line extensions or non-renewable supply facilities.

In addition to benefits to Ontario Hydro and its electricity consumers, the RETs Program will have potential spin-off benefits for the fledgling RETs industry in Ontario. For example, a 600 kW wind turbine recently installed by Tacke Windpower, the Canadian subsidiary of Tacke Windtechnik of Germany, at a site adjacent to the BNPD has lead to Tacke developing a blade manufacturing plant near London, Ontario. The plant will create 60-70 permanent jobs and will ultimately produce about one-third of Tacke's annual global blade production, valued at about $9 million per year.

Ontario Hydro Technologies' recent acquisition of Texas Instruments' solar cell technology could also lead to the development of an Ontario-based solar industry that could facilitate more cost-effective deployment of photovoltaic and solar thermal technologies domestically and globally.

RETAIN/ATTRACT CUSTOMERS

With an historic monopoly on electricity supply within Ontario, Ontario Hydro is at risk of losing customers to competition from other energy sources and other suppliers of electricity. Key factors for retaining and attracting customers will be the cost and quality of the products and services Ontario Hydro provides. Previous examples have considered how SED is linked to reduced costs. SED can also enhance the quality and functionality of Ontario Hydro's products and services in the market place.

(a) Electrotechnologies Addressing Customers Needs

By developing or applying sustainable technologies for the use of electricity, Ontario Hydro can provide increased value to customers as well as create new opportunities for the use of our product.

During 1995, Ontario Hydro entered into agreements with two large Ontario companies which will lead to industrial developments using advanced electrotechnologies. In one, a pulp and paper mill in Northwestern Ontario will make use of thermomechanical pulping technology. This technology will use considerably more electricity than conventional methods. However, thermomechanical pulping will also result in environmental benefits such as reductions in liquid waste and nearly 100% utilisation of wood. In the second agreement, a steel company will build a mini-mill in Southern Ontario using arc furnace technology. Again, this process is electricity-intensive but has many environmental advantages relative to conventional steel making technologies such as recycling and reuse of scrap steel, lower atmospheric emissions of toxic substances generated in coking and reduced water pollution.

Other examples of successful applications of electrotechnologies include:

- the installation of aeration equipment by a paper mill in Northwestern Ontario, to treat their pulp and paper effluent which resulted in an increase in their electricity load as well as cleaner effluent for disposal; and

- the use of induction heating and powder coating by a reinforcing steel bar company in Southern Ontario that led to an increased electricity load and reduced emissions of volatile organic compounds (VOC).

Other smaller scale, but more numerous applications, of electrotechnologies continue to take place. High efficiency lighting and motors are examples. Others involve the use of microwaves in wood drying, where costs are reduced and throughput increased, and infrared in curing and drying operations, where VOC emissions are eliminated. In all cases, electrotechnologies are able to provide economic advantages to the customer and improved environmental performance.

(b) Green$hare

Ontario Hydro is currently developing a program to allow customers to voluntarily contribute to the development of new green sources of electricity by buying *Green$hares*. The program will be pilot tested in 1996. This program will give customers the opportunity to purchase "shares" or "units" of green power which are

non-convertible, non-dividend paying, and non-equity shares. *Green$hare* contributions would flow into a Green Fund which would be used to fund new RETs projects.

Public attitude research, recently carried out in Ontario and North America, indicates that there are consumers who would be willing to pay more for goods and services that protect or enhance the environment. And, more narrowly-focused research suggests, there is a "niche" market of customers who are concerned about the long-term consequences of the way in which their electricity is produced and who would be willing to participate in customer-funded programs to increase generation of electricity from mature renewable energy technologies. This is a potential market which Ontario Hydro has not yet explored.

Through *Green$hare*, Ontario Hydro can:

- offer its customers an enhanced range of products and services by providing the opportunity for them to voluntarily participate in the development and use of RETs;
- work through strategic alliances with the renewable technologies industry in the province to develop and maintain RETs projects;
- assist in the development of the renewable energy technology industry in Ontario; and
- attract and retain customers by differentiating itself from other electricity suppliers.

(c) ISO 14000 - Environmental Management

The International Organization for Standardization (ISO) is developing ISO 14000 standards that will direct companies how to manage, measure, improve and communicate the environmental aspects of their operations in a systematic way. As with the ISO 9000 quality standards, it is anticipated that failure to conform to the standards could severely restrict business opportunities abroad. In addition, government agencies may use the standards as benchmarks in determining the environmental compliance status of a company. In 1996, Ontario Hydro is identifying what requirements, in addition to its existing programs, will be necessary to meet ISO 14000 standards in the areas of environmental management systems (EMS), environmental auditing, life-cycle assessment (LCA) and environmental performance evaluation.

It is anticipated that the use of a globally-accepted standard for EMS will provide benefits, such as:

- increased due diligence through the application of an accredited environmental management system;
- increased due diligence due to a certified audit process to verify the comprehensiveness of the system and its performance;
- reduced insurance costs because of reduced environmental liability;
- increased shareholder and customer confidence;
- enhanced image and the potential to increase market share; and
- improved accountabilities and management response capabilities.

(c) Brand Differentiation

Ontario Hydro's corporate reputation is influenced in part by how customers view its environmental performance. As previously stated, customers expect Ontario Hydro to be a leader in environmental management. Recent environmental awards won by Ontario Hydro include: the Financial Post Gold Award for Environmental Reporting - Utility and the U.S. EPA 1995 Stratospheric Ozone Protection Award.

It is likely that environmental performance may be one way of differentiating Ontario Hydro from other energy service suppliers. Success in sustainable energy development may enhance success of sales efforts by reinforcing Ontario Hydro's reputation of environmental integrity.

FUTURE CHALLENGES

As Ontario Hydro moves to a more competitive environment, there will be a number of challenges for the SED program; for example:

- continuous improvements in environmental performance without significantly increasing the resources currently dedicated to environmental protection. To gain this advantage, current approaches and expenditures need to be examined and alternatives sought at a lower cost, or higher performance level. This approach requires on-going monitoring and verification and can be applied in such areas as pollution prevention, air emission reductions, management of conventional and toxic wastes, and a range of energy and resource (i.e., chemicals, materials) use efficiency initiatives.
- further in-house energy efficiency improvements by focusing on thermal conversion efficiencies - getting more electricity/steam to the grid per unit of fuel consumed. Even minor improvements to the efficiencies in several of these areas can yield significant savings and enhance Ontario Hydro's competitive position.
- continued development of RETs which offer long-term benefits by giving necessary experience in leading-edge technologies. The future application of these technologies offer the opportunity of providing a broader range of power services to satisfy customer needs and expectations.
- improvements in financial and human resource management in costs per unit energy, improved employee productivity in GWh sold per staff FTE, and a reduced accident severity rate to provide more productive hours of work, as well as in changes in skills. All are essential drivers for improved performance and enhanced competitive position for Ontario Hydro.

On the other hand, Ontario Hydro acknowledges that some corporate SED initiatives may not be supported by the cost pressures of a competitive, open market - their benefits are viewed as societal and long term, rather than customer-specific and immediate. In the near term, Ontario Hydro may find it difficult to pursue and support these SED initiatives as they are currently designed. Some may require refocussing within Hydro; others may be better served by partnerships with external agents. A further set of SED initiatives which are viewed as having broad societal value, may require some type of external mechanism to either bridge these activities until such time as they become competitive (eg., RETs with their declining cost curves) or to maintain the necessary policy framework to ensure that the greater societal good is being served (eg., biodiversity, externalities). Such mechanisms could take the form

of regulations, standards, fees/charges or use of economic instruments, but must apply to all players in the energy market place.

CONCLUSIONS

Ontario Hydro supports the view that the companies which will be setting the competitive standard in the future will be those companies that see environmental requirements/issues as business opportunities and not just added costs. For Ontario Hydro, SED is the pursuit of operational excellence in a range of business activities that build on the company's earlier technological successes, quality management accomplishments, and advances in environmental performance.

Ontario Hydro's SED initiatives have been focused, and need to continue to focus on strengthening the relationships among economic/financial, environmental, and human resource management performance to enhance competitiveness. The plan is to motivate the company to continuously improve its performance in these areas by focusing on technological advancements and resource/energy efficiency improvements, using specific performance indices and targets.

APPENDIX D

Open Markets and Ownership

OPEN MARKETS AND OWNERSHIP

A Discussion Paper
Exploring the Relationship between Ownership and a Fully Competitive Electricity Market in Ontario

This paper examines the impacts of ownership and ownership changes on industrial restructuring in Ontario's electricity industry. The paper considers some of the complex relationships between industry ownership, competition, and benefits to the province of Ontario.

The purpose of this paper is not to argue a case for or against any particular form of ownership. Nor is it the purpose of this paper to make recommendations about ownership change as an instrument for achieving specific objectives. The paper is not intended to examine various mechanisms for divestment, although it does touch on issues that may be barriers to, or supports for, ownership change.

I FROM MONOPOLY TO COMPETITION

Since 1906, the people of Ontario have been well served by a public monopoly in electricity. However, today the industry in Ontario, as elsewhere, is on the verge of unprecedented changes in structure and in regulation.

Several major forces are driving change. The first is a fundamental change in the economics of electricity supply. There has been an eclipse of the rationale for the traditional monopoly in electricity, and a growing view that open competitive markets provide greater benefits than a single monopoly supplier.

One of the key components driving the impetus toward competition is technological change. The commercial availability of low cost, small scale independent generation has undermined the traditional economic advantage of large-scale generation. Distributed generation, made possible by these smaller

cost-efficient plants, can serve localized markets. This flexibility is a characteristic of a competitive industry, not a natural monopoly.[1] Similarly, the lower capital cost of small-scale generation means that capital needs are no longer as important a barrier to entry.

A second driver is a fundamental change in the nature of what customers are demanding. The pressures of global competition are causing industrial customers to aggressively pursue every opportunity to reduce production input costs, including energy costs. Electricity customers, industrial, commercial and residential, are becoming less satisfied to be captive to a monopoly supplier.

The greater desire by and pressure on customers to control costs has combined with better technical opportunities to do so, resulting in increased risks of customers exercising their choices and by-passing the public system. Customers have also experienced the benefits of choice resulting from the successful deregulation of other industries -- in transportation, telecom, natural gas and financial services. This has strengthened the case to introduce competition in the electricity industry.

A third driver is convergence among industries, technologies, and markets, as electricity and electrical services become more intertwined with other energy, wired and wireless services. There will be growing pressures to allow and promote convergence, and this will require that customers be empowered with choice of suppliers and that suppliers be allowed access to customers at the retail interface.

The development of competition, convergence, and customer choice characterizes the future business environment for electricity, and it is this future environment that gave rise to Ontario Hydro's proposal described in the paper ("*Competition, Convergence, and Customer Choice*") for restructuring the electricity industry in Ontario.

Hydro's proposal addresses many aspects of industrial and regulatory restructuring -- access by suppliers to the Grid; choice of suppliers by retail customers; the disaggregation of generation, transmission, distribution, and energy services; the establishment of a spot market in electricity; the desirability of retaining a single system operator; and the legislative and regulatory changes needed to make this come about.

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[1] Studness, C.M.; "Four Paths to Competition", Public Utilities Fortnightly, May 1, 1995, p. 40.

However, the paper does not address the role that divestment of all or parts of Ontario Hydro and the Municipal Electric Utilities might play in the path to, or operation of, a competitive structure in electricity. While the proposed structure does acknowledge that financial restructuring (including whole or partial privatization) could be easily accommodated in the new structure, it does not discuss the costs or benefits of doing so.

The paper "*Ontario Hydro and the Electric Power Industry: Vision for a Competitive Industry; Helping Ontario to Thrive to and Beyond 2000*" by the external Financial Restructuring Group (FRG), looked at the mechanics for introducing more external equity into Hydro, with a focus on how to improve the financial integrity and flexibility of the Corporation and of the Province in a more competitive environment.

This paper is intended to fill a gap between the analysis done on industry and regulatory structure, and the analysis done on equity and ownership. It examines the relationship between competition and ownership. Specifically it asks what are the implications of a competitive market on ownership?

In coming to grips with that question, it draws on the analysis of financial restructuring presented in the FRG paper, and on the analysis of the competitive environment presented in the "*Competition, Convergence, and Customer Choice*" paper. In identifying the potential role and benefits of private investment in a restructured industry, it focuses on four key areas of investigation and analysis:

- What are the forms of privatization and other ownership that might be applied to the electrical utility sector?
- What is the rationale for a change in ownership, including privatization, in the electricity industry?
- Does a change in ownership of Ontario Hydro, including privatization, facilitate the establishment and continuation of competition in Ontario?
- Does a change in ownership of Ontario Hydro facilitate the establishment of a competitive Ontario electricity industry in an open North American market?

Each of these themes is examined in the following sections.

II THE FORMS OF PRIVATIZATION

The term privatization is commonly understood to mean the sale of a government asset or company, in whole or in part, to private investors. While privatization implies a change of ownership, a change of ownership need not imply privatization.

Towards Privatization

There are many ways by which ownership can change. The ownership of the electric industry is now evolving in response to market forces and new technologies. New product and service markets are emerging. As part of this evolution Hydro's ownership structure could also change, say through strategic partnership, alliances and joint ventures with converging industries.

If government wants to improve efficiency in the industry and believes that this should be achieved through greater private sector participation, but wishes to retain control of the industry, it can require that the utility increase its purchase of products and services from private suppliers. This increased participation by private suppliers alters the ownership profile of the industry and amounts to a *de facto* privatization.

Similarly, government can incorporate elements of both public and private models into a single entity. Through "corporatization" government transfers responsibility into a separate commercially oriented entity which adopts managerial and financial accounting structures and systems intended to emulate private sector operations and performance. To a great degree this describes Ontario Hydro in its current form. Thus, although Hydro is wholly publicly-owned, it is structured and operates in many ways like a private commercial enterprise.

The Main Forms of Privatization

Privatization covers a wide spectrum of restructuring actions, ranging from a variety of forms of sale of assets or shares, through to the simple introduction of private sector management skills and approaches, without ownership

change. Government objectives should dictate the choice of the appropriate form.

There are generally four typical forms of privatization. These forms include:

(a) *divestiture* -- involves the sale of assets or shares by government to private sector investors through many means including: private sale, public offering of shares, buy-out by management and/or employees, or a combination of these.

(b) *private competition* -- involves opening the market and allowing private and public entities to compete on an equal basis.

(c) *private provision of infrastructure* -- involves government allowing the private sector to provide production to the government utility through concessional and contract arrangements, eg. build-own-operate (BOO) and build-operate-transfer (BOT) schemes.

(d) *contracting out* -- contractual arrangements between the government utility and private suppliers for the provision of services previously supplied by the utility itself. Generally this does not involve changing the ownership of infrastructure/capital. In effect, this is leasing government facilities to the private sector to run.

Hydro is already moving along this continuum. With a spot market in energy already in place as the forerunner to fully competitive markets in energy and capacity, Hydro is preparing for the private competition form of privatization.

Divestiture represents a change in ownership. Sale of assets will result in a change of ownership in the industry. Sale of shares will result in a change of ownership in the Corporation. The choice of which divestment strategy to pursue will depend upon the objectives of government and its desired role in the industry.

If government desires to foster competition in the industry it may prefer to restructure the Corporation, reconfiguring generation assets in several competing businesses then divesting 100% of ownership in the firms. This would address the problem of Hydro's market power and, if divestiture was complete, most of the self-dealing concerns. To the extent possible, government should attempt to ensure that ownership is spread among a large

number of disparate autonomous investors. To this end, it may seek to restrict share ownership to avoid control/influence problems (ie, market power and self-dealing). It may also want to limit foreign ownership to maintain sovereignty over Ontario's natural resources, or provide incentives for Ontario residents, employees or others to broaden ownership. This may also provide an effective response to social and political objectives of divestment.

III THE RATIONALE FOR PRIVATIZATION

It is important that government be clear about its objectives for privatizing and recognize that some form of ownership change may advance some objectives while hindering others. For example, maximizing revenue from a divestiture (ie. revenue enhancement) could be very much at odds with the policy objective of increasing productive and allocative efficiencies in the industry.[2]

Government, much like private businesses, may have a number of reasons for wanting to divest of business areas and assets. Among the common objectives are:

1. To generate revenue for government -- often the case with cash-strapped governments, or with governments that have put a high priority on debt reduction.

2. Ideology -- governments which believe as a matter of principle that government's place is not to be an active player in the industry, but rather an overseer of it.

3. To get out of the role of owning and controlling an industry -- unlike the second reason cited above, government's desire to exit an industry may not be ideological, but simply a belief that their presence there is no longer an advantage to the management of the industry. Government may view as a political liability the accountability it shoulders as a controlling owner.

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[2] To maximize the value of the utility to potential investors, government may chose to forestall competition for a period of years.

4. To transfer risk from the government to investors -- in a mature industry, government may feel that it is time to transfer financial risks from itself to investors and customers.

5. To facilitate further development of the industry -- governments may recognize the need to put an industry on a commercial footing for future convergence or partnering.

6. To facilitate the development of a competitive industry -- governments may believe that divestiture to other owners is critical in achieving effective competition.

A brief review of these themes follows.

1. To Generate Revenue for Government

Revenue generation through the monetization of utility equity is a compelling financial strategy for deficit-cutting and debt reduction. This was a major driver behind the privatization of Nova Scotia Power,[3] as well as the UK government's sale of the CEGB. Taxpayers benefit if reduced public debt load exceeds the net incremental costs to customers from transferring ownership to private interests (ie. recapitalization costs, taxes and dividends).

Maximizing the Value of the Sale

If revenue generation is the leading objective, then government should maximize the value of the utility to potential investors/purchasers. This may compromise other objectives, such as promoting the growth of a competitive market. Maximizing the sale price suggests maintaining the utility as a large integrated monopoly. The sale of Nova Scotia Power was a sale of a monopoly. It replaced a publicly-owned monopoly with an investor-owned monopoly. Retention of the monopoly was a critical consideration in the financial community's valuation of the NSPI shares and therefore was critical to extracting maximum value from the sale. Unfortunately, these two

[3] Nova Scotia Power was privatized in August 1992. At the time it was the largest share offering for 100% of ownership. The sale of $ 851 million in common shares ($201 million to the Province of Nova Scotia) increased NSPI's common equity base from 5% to 31%, and reduced net debt by $615 million. Additional preferred shares were added in 1993 which provided the capital to enable the utility to borrow as a stand-alone credit.

requirements -- retention of a monopoly and continued functional integration -- work contrary to advancing the cause of market forces and introducing competition.[4]

Divestiture of selected parts of the business or a partial divestment of the integrated business to inject equity and strengthen capital structure are alternative strategies. Equity infusion strengthens the balance sheet and introduces a measure of financial flexibility which enhances the competitive position of the utility to the benefit of customers. However, unless government divests the majority of its holdings it has not relinquished control. Majority ownership by government may also make it difficult in future to acquire partners, pursue merger opportunities, or other strategic alliances and restructuring options. In this case investors might discount the value of the share offering[5].

The Need for Disclosure

The Hydro proposal on restructuring assumes a five-year transition to full competition. The Ontario monopoly electricity system is not seen as sustainable. Given requirements of fairness in disclosure, if government were to attempt divestiture of the utility as an integrated monopoly, it would have to be for a limited period of time, and it would have to be clear to investors what the transition steps to competition and what the interim and ultimate regulatory structure under privatization would be. This would define the risk to investors. Otherwise, under uncertain conditions the market value of the shares would be discounted and the proceeds/benefits to taxpayers from the sale would be reduced.

Clarifying Ownership

One assumption about revenue generation that needs to be clarified is government's ownership of Ontario Hydro, and its claim to the proceeds from divestiture of Hydro's assets. If ownership is simply defined as having a controlling influence, then the provincial government through its legislative

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[4] An alternative to retaining the monopoly could be the use of long term vesting contracts (such as in Alberta) which would guarantee a healthy revenue stream to the investor. This also would act to constrain competition.

[5] Investment advisors to the FRG strongly maintained that a sale of shares would only be feasible if government committed to full divestment over time.

powers is the owner of Ontario Hydro and may at its discretion enact the necessary statutory measures to allow for a change in ownership of the Corporation. However, if ownership is defined as a legal right of possession, then there will need to be greater clarity as to the current ownership of Ontario Hydro before a transfer of public assets and risk to private investors can be considered.

If it is accepted that ownership in the future will be transferred to new investors who put their capital at risk in Ontario Hydro, then the case can be made that the current owners are those who already have their capital at risk -- that is, the Province's electricity customers. If government is successful in selling the utility and customers are successful in extracting compensation for their equity, then unless the realized market value of the utility is in excess of its book value, it is difficult to see how government (and taxpayers) will benefit from the sale in terms of net proceeds.

Furthermore, given the potential magnitude of the sale, there could be a challenge of the government's claim to ownership by the municipal utilities and/or municipalities, forcing the ownership issue into the open public arena. The combination of ambiguity over who owns Hydro, and the Province's legal authority to sell it, could lead to uncertainty in the financial community, and a market discounting of the value of the sale.

Public Acceptance

Another consideration for divestment is public acceptance. Under privatization, the rights to use natural resources, rights currently held by Hydro as a public trust, will be turned over to private interests. This could prove unacceptable to many Ontarians who believe that the province's natural resources should be used for the public good and not for private gain. It is noteworthy that the majority of the hydroelectric facilities in North America are owned by publicly-owned utilities, and that Canada's two largest investor-owned utilities own primarily fossil/thermal generation. The proceeds expected from divestiture may not be seen as sufficient to adequately compensate a public which, to varying degrees, may be of the opinion that it is selling off its natural heritage.

In sum, privatization will produce revenue -- the magnitude of which will depend in part upon the extent to which investors will discount share value commensurate with their assessment of risk. This will be determined in part by the willingness and ability of government and regulators to provide contractual commitments which mitigate the uncertainty regarding future restructuring of the industry. Experience in the deregulation of the natural gas industry has shown that such developments are both possible and workable.

2. *Ideological Commitment to Private Sector Involvement*

Some governments are committed to divestment for ideological reasons: their belief is that the government should avoid being involved in owning and operating businesses which can be adequately provided by the private sector, and should confine itself to making the proper rules for fair competition. Such was part of the U.K.'s decision to privatize the telecom, gas, and electricity sectors. In Canada to date, government decisions about involvement have generally been driven by more pragmatic reasons, for example to reduce debt and spending.

3. *To Reduce/Eliminate Government's Responsibilities in Owning and Controlling a Huge Manufacturing Concern*

Government decides to get involved in an industrial sector when there are aspects of that sector that do not permit a fully competitive market to develop. If government steps in when there is a perceived failure or inability of the market to produce results which are acceptable to the public interest, then government is willing to participate in that market and to bear the risks and potential costs of intervention. Historically, the requirement for low cost capital to finance massive infrastructure investments meant economies of scale and a monopoly infrastructure. Once the decision on a monopoly is reached, the government has three choices: whether to exercise control through regulation, through ownership or through both.

<u>The Declining Need for Government Ownership</u>

With the maturing of the electricity industry and increasing pressure from some customers to allow for the emergence of competitive markets, the

rationale and continued relevance of government involvement is being challenged. "Electric power, and in particular the generation of power, is seen around the world as a commodity. The provision of this service is no longer seen as needing government ownership".[6]

Much of the advocacy for privatization is based on eliminating the possibility of capricious intervention or "meddling" by government in an industry where government presence no longer plays a useful role. Among some customers there is the concern that as long as Hydro continues to be an arm of government, however remote, there remains the possibility (ie. the risk) that government will intervene, either for reasons of political expediency, or due to policy reversals resulting from the periodic change of government. Governments themselves may want to extricate themselves from accountability in this way, and prefer the much more direct route of exercising oversight with control through regulation.

Retaining Influence Through Regulation

It is necessary to distinguish between the commercial self-interest of government as the owner, and the guardian role of government, representing and safeguarding the interests of the customer. These roles are different and often in conflict. One way to clearly separate these is to delegate responsibility for ensuring delivery of government programs and safe-guarding customer interests to an independent regulatory body. Public policy objectives can be successfully pursued through the use of energy taxes, transmission charges, universal service charges or other market mechanisms. Thus it is possible for government to retain this regulatory role and transfer ownership to the private sector.

And yet, governments worldwide are seeking to reduce the scope and scale of their regulatory involvement in the industry, and to rely more on competition and the discipline of the market to achieve increasingly modest public policy objectives. Traditional cost-of-service regulation is perceived as a flawed proxy and poor substitute for competition that has not worked well. The regulation of monopolies tends to result in prices which send distorted signals

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[6] Farlinger, W.A.; Homer, G.J.; Caine, B.S.; "Ontario Hydro and the Electric Power Industry", June 1995, p. 3.

to the market.[7] In competitive markets, prices generally reflect the customers' willingness to pay.

Public Benefit Through Competition

In the majority of cases where regulated monopolies have recently been replaced by competitive models, the advent of competition has resulted in improved performance, occasionally lower prices and an expansion of service/product options. If government's indirect participation in the industry as a regulator is to be reduced, it will be that much more challenging to identify a reasonable logic for government's continued direct involvement through a yet more intrusive presence -- public ownership.

Public power advocates argue that electricity is a public good, an essential service, too important to leave to the marketplace. It should be available to all, without discrimination.[8] Because electricity plays an important role in economic development and is an important vehicle for the delivery of public policy objectives, no government should relinquish control. And yet there is a host of other goods and services which are also generally regarded as essential, such as food production and distribution, which are almost entirely in private hands and serve the public in an effective and cost efficient manner without direct government intervention.

4. To Transfer Risk from Government to Investors who are Prepared to Economically Manage It

The electric utility industry historically has been characterized as a sector with "predictable markets, low price volatility, low interest rates, and good capital availability (which) added up to an industry with low risk".[9]

Risk Under Public Ownership

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[7] Under cost-of-service regulation, capital cost recovery is based on historic or embedded costs rather than long run marginal costs.

[8] The establishment of the monopoly -- the granting of special rights, is linked to the notion/perception that this service is an essential public service.

[9] International Energy Agency; Electricity Supply Industry: Structure, Ownership and Regulation in OECD Countries; OECD, Paris, 1994, pg. 13.

Structure and ownership profoundly affect the incidence and allocation of risks in the industry. There are several ways in which monopolies, particularly publicly-owned monopolies, reduce risk. Government as owner and regulator can ensure that the utility, to a certain point, will be able to recover its costs. This transfers the price risk to the customer, who because of the industry's monopoly structure has no choice but to pay the cost-based rate. It also shields the utility from market risk -- the wide-ranging risk that all businesses face due to changes in broad economic conditions. In addition, Government's guarantee of Hydro's debt, which allows its highly leveraged capital structure, reduces Hydro's financial risk. This benefits customers. Only in the case of a major loss, where cost recovery through rate increases would not be practical, would financial risk be transferred from the ratepayer to the taxpayer, as government would be forced to (i) provide a subsidy to cover the utility's revenue shortfall, and/or (ii) indemnify the utility from the liability to provide compensation in the case of a catastrophic event.

Risk Under Private Ownership

Even where monopolies persist, ownership does make a difference -- the alignment of risks is very different under private monopolies. Regulators attempt to balance the competing interests of shareholders and ratepayers, and set prices which reflect the risks borne by both. For their part, shareholders attempt to transfer risk to others -- upstream to suppliers, and downstream to customers.

Growing Risks in the Electricity Business

As the industry matures it faces new risks. The recent decline in share value of US electric utilities is an indication that the level of risk in the industry generally is increasing. Slower growth in demand, surplus generating capacity, under-performing nuclear assets, uncertainty regarding recovery of embedded cost in a more open market, the growth of NUG/IPP generation, the future role of brokers and marketers, and a host of other factors underlie this perception of increased risk.

These changes reflect the transition to competitive markets. A first step in this transition is the functional unbundling of the vertically integrated utility to get greater transparency of costs and more efficient pricing. Restructuring, narrowly defined as unbundling and adopting new organizational structures, while potentially contributing to the greater efficiency of the industry and

therefore a reduction in the magnitude of risk, need not produce a change in the allocation of risk.

How Competition Changes Risk

The introduction of competition however, radically alters the risk profile of the industry. "The movement to competition changes the foundation principle on which the financial structure and strategy of the electricity industry is built. The principle is that in a regulated, or publicly-owned monopoly the product is priced to recover its cost, including the financial cost. Because in a competitive market the product's price is not related to its cost, the recovery of the financial cost is not assured. That one change alters everything else".[10]

In future, contracts will to a certain extent replace regulatory oversight as the principle means of assigning and managing risk in competitive markets. With more diverse players and less intrusive regulation, business risks in the supply industry should increase. Conversely, if effectively managed, the price risks for customers freely exercising choice of supplier, should be greatly reduced. For other customers price risk may increase.

In Ontario the customer currently bears most of the risk in the industry. This is consistent with the notion of risk and reward -- it is the customers who have contributed the equity, who have put their capital at risk -- and it is the customers who benefit from their capital contribution through lower rates. Although government may have guaranteed Hydro's debt, it is highly unlikely (with few exceptions) that the Corporation would call upon the guarantee -- rather it would either draw on equity (as it has in the past), or increase rates to cover any shortfall in revenue. Only in a monopoly is this loading of risk onto the customer (by Government, suppliers and Hydro) made possible.[11] In a competitive market this is not possible -- any attempt to recover costs from

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[10] Doudiet, J.T., "Financial Strategy in an Increasingly Competitive Marketplace", cited in Hyman,L.S., The Privatization of Public Utilities, PUR Publications, 1994.

[11] Similarly, in regulated monopoly, such as in the US, the regulator will pass along to ratepayers the cost impacts of adverse outcomes, eg. fuel price increases. Cost-based rate-making tends to shield the owner/investor from risk.

customers through rate increases will simply result in a loss of market share.[12] If Hydro finds that it is uncompetitive in a competitive market, the government (ie. the taxpayer), will have to provide a subsidy to cover any revenue shortfall.

Competition therefore will transfer this risk from customers to taxpayers. The Government can try to shield taxpayers by attempting to forestall competition and maintain the monopoly. But even if it were possible to maintain the monopoly and avoid stranding, government would be denying to customers the benefits of lower rates that competitive markets are believed to produce.

Given the inevitability of open competitive markets for electricity, government must determine whether it is prepared to expose the taxpaying public to the risks and associated costs of stranding uneconomic generation assets, as well as the potential benefits os competitive markets, by maintaining its current ownership position.

If investors are available and willing to assume these risks, then government might want to allow these parties to assume the risks and rewards of ownership. On this basis, it would appear that private ownership provides a different alignment of risks, responsibilities and rewards.

5. Alternative Ownership Structures will Facilitate Convergence

Success in competitive commodity markets for electricity and energy service markets will require innovative approaches and flexibility to respond quickly to emerging opportunities. The statutory restrictions and requirements, as well as the unique public policy obligations that burden publicly-owned utilities will put them at a competitive disadvantage in the future industry. If Hydro is to develop new skills, new product and service markets, new functionality, new revenue streams, it must be able to operate under similar commercial freedoms and capabilities that private business corporations enjoy. It must also be prepared to be regulated in a similar fashion to its private sector counterparts.

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[12] Much depends upon how the industry is structured for competition. The Alberta competitive system which will be introduced in 1996, guarantees recovery of fixed costs to utilities for existing generation through imposition of a reservation payments. Thus existing assets are not exposed to the increased risks of a competitive market.

Given this freedom, it can be expected that Hydro could evolve in new and different directions. In time core business activities can be expected to shift away to some degree from traditional approaches in generation, transmission, distribution and retail services. Hydro will want to identify and exploit the value in its underutilized asset base, build on its core competencies, and leverage these resources to its competitive advantage. Ultimately, the pursuit of financial gain or benefit could lead to a re-invention or re-definition of the Corporation, in whole or in part.

Ownership Needs Will Change

Depending on corporate objectives, pursuit of these opportunities may involve strategies and tactics which will necessitate and lead to the altering of the current corporate ownership structure. For example, if the focus of future business activity involves a new area, the continued ownership of certain assets may become unnecessary, in which case value may be extracted by either fully or partially divesting of the assets. This would alter the ownership of the industry, if not the Corporation. Similarly, a greater reliance on purchased services would strengthen the private sector participation in the industry without altering the ownership of the Corporation -- although there may be value in Hydro acquiring an equity position in such undertakings.

Another option is public-private partnerships in areas where private sector assets and expertise are complementary to Hydro's needs.

The acquisition of equity positions in privately held companies does not alter the ownership of Hydro, although it could be a consideration in partnership agreements, joint ventures or other formal alliances. It may be necessary for Hydro to pursue these collaborative strategies, primarily as a source of new revenue, and secondarily as a cost effective means of acquiring new skills, accessing new markets, and sharing the risks of new business ventures.

6. To Facilitate the Development of Competition in Electricity

One of the key reasons for changing ownership is to enhance conditions which are likely to lead to effective competition in electricity. In some former monopolies, the regulator forced divestiture and break-up. Since this reason for divestiture relates directly to competition, the next section of this paper deals with it in some detail.

IV DOES A CHANGE IN OWNERSHIP (INDUSTRY PRIVATIZATION) OF ONTARIO HYDRO FACILITATE THE ESTABLISHMENT OF COMPETITION?

One important part of the rationale for restructuring the electricity industry is that disaggregation of the integrated utility and opening the industry to competition will create strong incentives to drive efficiency improvements. An equally important part of the rationale is that customers should benefit from these efficiency improvements.

Market Power

It is generally held that competition requires a large number of buyers and sellers, none of whom is large enough to affect the market price. A potential barrier to the development of competition in the electricity industry in Ontario is the market power of Ontario Hydro generators.

Ontario Hydro currently supplies 94% of the electricity sold in Ontario. There is a limited capability for independent power producers within the Province to increase their supply. Generators outside Ontario could supply about 4,000 MW of power out of a total provincial demand of about 22,000 MW. Two key components in Ontario Hydro's proposed structure is giving retail customers the option of choosing their own suppliers of electricity and the establishment of a spot market in electricity. Hydro's market power raises a concern as to whether there is enough non-Hydro-owned power available to allow a choice of alternative suppliers in any real sense of the term.

One school of thought, voiced by Bill Hogan of Harvard University, is that access to alternative suppliers, even if they have only a small share of the market, is sufficient to create competitive price pressure and disciple the market.

Others feel that stronger measures may be necessary. The UK is frequently cited (by AMPCO, among others) as an example where divestment of generation under three separate owners did not create sustained, effective competition. Ontario's situation is different, however, in that we are interconnected with large transmission groups and generators across the continent. It has been noted that, "By traditional economic benchmarks, three or four generating companies would be viewed as suspect in terms of

satisfying the requisites for creating effective competition. However, the economic power of relatively few companies selling a commodity that does not lend itself to product differentiation, operating in a market characterized by competition with equally strong financial entities outside Ontario, and with the ability to sell power in a spot market (Exchange Pool) are factors that help to create an environment in which effective competition may be possible."[13]

Central to the issue of market power is the assumed size of the market area. If the market area were limited to Ontario, it would appear necessary to deal with Hydro's market dominance and break up it's 90% block of total generation capacity. If, however, one thinks of the 20% interconnections transfer capability as an entry point for not only physical trading of electrons, but also for financial contracts of a commodity creating a financial (paper) market many times larger than the physical (electron) market[14], then the value of and requirement for divestment of generation to foster competition is reduced.

Even if a larger "cross-border" market in electricity develops, it is not evident that either the privatization of Ontario Hydro, or the introduction of private equity into the corporation as a whole does much to foster competition. What would help competition (in a closed Ontario market) would be the divestment of different parts of Hydro (particularly generators) to different and competing owners. However, since Hydro's generation system was designed to be complementary rather than competitive, there are major problems in identifying a reconfigured generation system which would be both economically efficient and result in effective competition.

Ontario's Divestment Hurdle

Divesting generation in Ontario might prove a considerable challenge. About 65% of Ontario Hydro's energy is generated by nuclear stations. There may be both technological reasons (keeping a unique technology intact), and public resistance (nervousness about safety) which could undermine the breaking up and sale of nuclear generation to the private sector.

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[13] Sherwin, S.F.; Narrowing Choices for Restructuring Ontario's Electric Power Industry; Foster Associates, Inc., Washington, D.C., July 1995, pg. 11.

[14] In the U.S. natural gas industry, the volume of natural gas financially traded is four times the physical volume of gas actually transported.

Furthermore, as nuclear facilities are highly capital intensive, it is probable that long term supply contracts with guaranteed prices would be a condition for financing such investments. In addition, potential investors would want protection against unforeseen liabilities (ie. accidents) and assurances that long term radioactive waste disposal would be available at predictable costs.[15]

Recognizing this, one consultant (S.F. Sherwin) has suggested a different approach for reconfiguring generation - to lease the CANDUs to different public or private sector firms. Hydro would retain ownership, but the different firms to which they were leased would compete for power sales to the spot market and contracts with customers. While this kind of arrangement undoubtedly has its own complications (for example, how it would work under Canadian and Ontario law, and how attractive it would prove to investors of the lessees) it does constitute an alternative approach to retention or full divestment. This leasing option could also be used with other generation plant.

Divesting without Privatizing

One must underscore the important distinction between divestment of ownership and privatization. Diversity of ownership and arms-length relationships are essential for effective competition. But does competition necessarily require the transfer of ownership to private investors?

Separate autonomous, publicly-owned entities do compete. Municipalities compete to attract industry. Public universities compete with each other and with private ones to attract students. Publicly-owned broadcasting competes with the private sector, although one must acknowledge that they are often given a (regulated) distinct public service role backed with associated funding.

In electricity, Norway in 1991 opened its totally hydroelectric generation and supply system to competition at all levels. There is one state-owned Grid company, 60 generation companies (80% of which are municipally or federally owned), 54 owners of medium voltage networks and 200 local distribution

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[15] Capital intensity is also a major consideration for the sale of hydroelectric assets, which are characterized by high initial capital cost, low operating costs and extremely long service lives. Given the significant proportion of costs associated with financing, plants must be financed cheaply (ie. debt at low interest rates). Private investors and their lenders will want assurance that the plant will have sufficient revenue to cover debt service costs. This implies the need for long term contracts with guaranteed minimum prices as well as guarantees from the Province regarding future water rental payments.

networks, mostly municipally owned.

In Australia, the state of New South Wales is planning to disaggregate its generators into three competing units, while amalgamating its 21 rural distributors into three or four. It does not believe that sale to the private sector is a prerequisite for competition. By contrast, the state of Victoria is restructuring for competition by privatizing.

Many analysts doubt whether there would be effective competition among publicly-owned generating companies.[16]

Mixed Ownership

The alternative of divesting some, but not all, generators leaves the question of publicly-owned generators competing with privately owned ones (as is the case now with NUGs and imports from IOUs in the USA). This raises questions of managing fairness and creating a level playing field. Publicly-owned utilities would not pay taxes and may have financing advantages over the private sector. On the other hand, there might be fewer impediments and burdens on the private sector player[17].

An alternative approach to divestment is to make the products of divestiture competing entities with mixed ownership. Since such entities would be accountable to their private as well as public shareholders, they could be presumed to take on the typical private sector incentives for competition.

There would be very little attraction of mixed private/public sector entities to potential investors. The government presence as an owner would likely be perceived as a constraint on day-to-day activities as well as to future mergers, acquisitions, partnerships and other strategic business development activities.

Self Dealing

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[16] It is evident that publicly owned utilities can and do compete out of their own areas of jurisdiction e.g., Electricity de France and Ontario Hydro compete in U.S. markets.

[17] Privately-owned utilities in the US are not without favourable tax advantages. A July 1995 study by MSB Energy Associates concluded that major tax subsidies to investor-owned electric utilities cost the US Treasury $US 10.86 billion in 1993, translating into a 7% increase in real rates.

Another major concern associated with moving from monopoly to competition is self-dealing.

Effective competition requires an adequate number of buyers and sellers, who have comparable access to transmission. There is a regulatory problem if Hydro remains a 'player' in generation, the transmission grid, the exchange/pool, and distribution facilities.

The concern is that certain generators may receive preferential treatment on transmission access or on bidding into the spot market if the owner of the transmission company or Poolco is the same as the owner of the generators.

For such a concern, the question of whether the integrated monopoly is in private or public ownership is not the issue, rather concern is over the concentration of ownership. Some commentators believe that the concern can be substantially reduced through regulatory oversight and functional separation of the generation, transmission, distribution and Poolco components into separate businesses, preferably with completely separate governance structures (ie. the approach proposed in Hydro's 4C's paper).

Others believe that such "safeguards" are so inadequate as to invite very heavy regulatory intrusion into the operation of the market (which is what the introduction of competition seeks to avoid), and on that basis conclude that only the complete divestment of generation (or alternatively, of the Poolco function) to another unrelated owner can ensure effective competition with light-handed regulation.

Can Change of Ownership Promote Competition?

Because markets are dynamic and unpredictable mechanisms, many economists are loathe to declare whether, how fast, or how much the divestiture of former monopoly components will create effective competition.[18] Ultimately, one has to let a new structure run, and see whether competitive behaviour is in evidence.

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[18] "The degree to which divestiture will create effective competition cannot be determined, a priori, with certainty. All one can hope for is that an industry structure that creates the conditions for effective competition will, in the longer run, achieve effective competition. It cannot, therefore, be assumed that, upon privatization, the degree of competition will obviate the need for price regulation." S. Sherwin "Narrowing Choices" pg. 45.

Nevertheless, one can aim to restructure in such a way that effective competition is more **likely** to occur. Divestment of generating assets to a large number of disparate owners is more likely to create competition than divestment to just two or three. Similarly, divestment to separate private owners sector is more likely to lead to competitive behaviour than divestment to discrete public sector owners, who might retain some of the vestiges of a common public service mentality, and be subject to government influence through ownership.

A former monopoly may retain ownership of its component businesses, and disaggregate them into separate business units. Such a corporate structure (competing subsidiaries) might go some way toward promoting competitive behaviour, but would fall short of the full effective competition test of a market.

V DOES A CHANGE IN OWNERSHIP OF ONTARIO HYDRO FACILITATE THE ESTABLISHMENT OF A COMPETITIVE ONTARIO ELECTRICITY INDUSTRY IN AN OPEN NORTH AMERICAN ELECTRICITY MARKET?

Section IV focused on the development of competition in Ontario. While it acknowledged the presence of suppliers outside the Province, the perspective was that of creating competition in Ontario by changing the legislation here, and taking other initiatives to make sure that effective competition could take place.

From the perspective of the boundaries of the Ontario electricity market in Section IV, the target beneficiary for introducing competition was Ontario's electricity consumers. Benefits to the Province would flow indirectly from

lower electricity prices and/or more or higher quality electricity service offerings.

For residential customers, this would take the form of higher value-added electricity services and/or lower electricity prices, freeing up income for other purposes. For business customers the benefits of competition would likewise take the form of lower electricity costs and/or higher value-added services. This would benefit Ontario as a whole since its businesses would be able to

increase their competitiveness by lowering the cost of electricity as an input to their overall business costs.

The benefits of ownership change flow from its ability (through divestment) to create competition. Section IV concluded that some divestment of parts of the integrated utility (especially generation) would be beneficial in establishing and maintaining competition.

Creating Competition vs Creating Competitiveness

This section considers broader developments outside of Ontario, and notes that preferred initiatives to establish competition in Ontario may not be preferable in the context of other developments farther afield. One key strategic objective of restructuring is to maximize competition in Ontario. Another objective could be to position the Ontario electricity industry as a major player in a deregulated international market. While not mutually exclusive, initiatives taken to maximize the one might detract from attainment of the other.

From the perspective of the individual electricity consumer, it might not be important where the low-cost or high-value supplier is based. Customers lower their input costs and improve their competitiveness regardless of whether the supply is based in Indiana or Ontario.

But from a broader provincial perspective, the retention and development of an industry based in Ontario does make a difference. The migration of industries from Ontario should be a concern regardless of whether such industries are users of electricity or providers of electricity services.

By all accounts, the configuration of suppliers in the electricity marketplace in North American is changing. We are seeing both acquisitions and divestitures primarily because companies are becoming focused on what businesses they want to get into, or out of. In this environment, retaining size, impact and flexibility to meet market conditions is a proven competitive advantage.

Therefore to divest of existing assets that contribute to net income potential and to weaken the competencies being developed would be a serious strategic step affecting the short and long term positioning for Ontario's competitive advantage. As the Financial Restructuring Group Report points out, "the advantage of having one large Generation Company would be that it could take

a very competitive role in marketing in the United States and internationally."[19] The 4C's report's rationale for keeping all Hydro's subsidiaries under a single parent is, similarly, not to preclude future reintegration.

In the event that assets could be considered advantageous in some market areas and not in others, an option to build in flexibility should be developed. An example of this could be to retain integrated ownership but to invite involvement of others in operations and management through a leasing arrangement. Retention of long term usage of the assets (facility, site, capabilities and competencies) could then be revisited as market changes suggest.

This international perspective puts a different light on divestment. It becomes less a tool for creating competition, and more an important consideration in foreseeing the development of a strong and competitive electricity industry based in Ontario.

Market definition remains a critical determinant of future strategy. If the Ontario market remains insulated from broader regional market forces, then the break up of Hydro's business units and assets among diverse ownership arrangements would appear to be a necessary pre-condition to effective competition. If however the Ontario market is exposed to similar forces which are sweeping other jurisdictions and other industries, and opened to extra-provincial suppliers, then there may be competitive advantage in the longer term to maintaining an integrated Corporate structure and pursuing ownership options on a different basis.

Instead of selling off parts of Hydro in order to satisfy the requirements for creating effective competition (and regulators in the US have so far been loath to order divestiture for integrated utilities) one might sell only those components that do not serve well a business development strategy for international competition. Similarly, Hydro might sell components for purely financial reasons -- to gain money to acquire complementary businesses or to improve the financial strength in businesses where competitive pressures

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[19] Farlinger, W.A.; Homer, G.J; Caine, B.S.; "Ontario Hydro and the Electric Power Industry", June, 1995, p. 29.

demand so. Partial sales and partnerships could be developed for similar reasons.

In a scenario where large international integrated utilities emerge as king, the preferred form of divestment might be equity infusion rather than piecemeal divestment. In addition to the reasons for government divestment noted in Section III, equity infusion could improve competitiveness by strengthening Hydro's equity base. It could accelerate the change to a more commercial corporate culture through monetary incentives for performance which investor owned utilities require.

Another consideration regarding divestment and the definition of the market area is that the natural tendency of regulators overseeing mergers and acquisitions is to make it more difficult for a regional provider to strengthen and expand by acquisition its market presence within its traditional base than to do so outside its traditional borders. For example, Scottish Power's bid for Manweb in the UK triggered monopoly concerns because it would mean internal industry consolidation which might reduce the number of competitors in the UK. By contrast, an external takeover, such as the US-based Southern Company's purchase of the UK's South Western Electricity Board, would not raise such concerns because of the lack of established presence by the external concern in the domestic market.

This has implications for changes of ownership in Ontario. For one thing, the evolution of ownership in support of competition would tend to favour a far greater mix of non-Ontarian, and non-Canadian ownership than Ontarians might be comfortable with for electricity. For energy in general, and electricity in particular, Ontarians have always indicated a strong preference for regional control and ownership (although these concerns do not manifest themselves in other essential products and services).

Secondly, if an Ontario-based owner were to divest of business units in Ontario, it would (from a mergers/regulatory standpoint) be more difficult to re-acquire them here than it would be to purchase interests elsewhere. The breakup of the concentration of ownership forces the issue of whether Ontario is looking purely to create competition in the industry for market/consumer benefits, or whether there are also public-policy driven objectives

(strengthening an Ontario-based electricity industry) attached to the introduction of competition.

This suggests that a fruitful area of analysis should be an assessment on how to maximize the competitiveness of Ontario electricity industry in a competitive North American market. Consideration of ownership should be part of, but not limit, the scope of that analysis.

Notwithstanding these uncertainties, it is clear that with the introduction of competition into Ontario's electricity services industry, the increasing privatization of that industry is assured. The speed at which privatization occurs, however, will depend on a number of factors: it will happen slowly if it is decided the existing infrastructure will remain in public hands and only incremental supply will be privately held; or it could happen almost immediately if the government declared an ideological interest in wholesale divestiture, or in simply reaping the gains from a sale. Likely the most important factor that will determine how quickly private interests will enter Ontario's power sector -- at least in the model proposed by Hydro -- is whether government, regulators and consumers believe a credible, fully functioning open market can result from crown-owned entities competing with each other. If they do not, earlier injection of private interests and equity will occur.

Ontario Hydro